

TerreSculptor

HMES - Heightmap Editing Software Reference Manual

Documentation for TerreSculptor HMES version 1.0.
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Preface

TerreSculptor HMES is the Heightmap Editor Software developed by Demenzun Media Inc. TerreSculptor HMES and its forerunner HMCS, Heightmap Conversion Software, contain a number of years of software development in the field of computer generated and manipulated heightmaps.

In order to appeal to a greater audience, TerreSculptor is available in both a Standard Edition and a Professional Edition.

TerreSculptor Standard Edition is no cost and includes a subset of the Professional Edition features. TerreSculptor Professional Edition is available for retail license sale and includes numerous advanced features. TerreSculptor Professional Edition is available for licensing by individuals and companies. Licenses are available on a per-seat or per-user basis.

See our website for current licensing and pricing information.

Look for the “*Professional Edition Only*” tags found throughout this document for the advanced features available only in the Professional Edition.

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Preface

Welcome to the *TerreSculptor Reference Manual*.

This reference manual is part of the documentation set accompanying the TerreSculptor software.

This reference manual covers a complete set of topics for learning and using the software. Topics include installing the software, fundamental concepts, user interface controls, managing the 3D scene including cameras and lights, how to use all of the included tools, as well as many step-by-step tutorials.

For the Adobe PDF version of the reference manual, it is beneficial to open the Bookmarks tab in order to have the Table of Contents always available for quickly navigating the chapters. The Bookmarks tab can be activated through the Adobe Reader's View menu or the Bookmarks icon on the left pane, depending on the Reader version.

About the Tutorials

The tutorials in this document assume that you are familiar with the terrain systems in the specified target video game engine. This document is a reference for the TerreSculptor software, it is not a reference for any of the mentioned video game engines. Refer to the documentation supplied by the engine developer/publisher for information on how to import and export files, perform basic level design skills, etc.

Reference Manual Conventions

This manual provides a significant amount of in-depth material accompanied by a large amount of graphical material and examples.

Notification Icons

This reference manual uses graphical icons to inform the reader of various actions.



Signifies important information

Mouse Icons

This reference manual uses graphical icons to depict the various possible mouse button and movement actions and combinations.



press the left mouse button



press the right mouse button



press the left and right mouse buttons



press the middle mouse button



move the mouse on its X axis



move the mouse on its Y axis



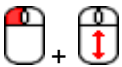
move the mouse on its X and Y axes



scroll the mouse wheel



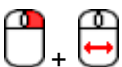
press the left mouse button and move the mouse on its X axis



press the left mouse button and move the mouse on its Y axis



press the left mouse button and move the mouse on its X and Y axes



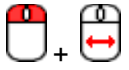
press the right mouse button and move the mouse on its X axis



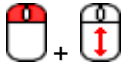
press the right mouse button and move the mouse on its Y axis



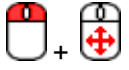
press the right mouse button and move the mouse on its X and Y axes



press the left and right mouse buttons and move the mouse on its X axis



press the left and right mouse buttons and move the mouse on its Y axis



press the left and right mouse buttons and move the mouse on its X and Y axes

Features

General Features

- Single executable file for both 32-bit and 64-bit Windows operating systems.
- Multi-threaded performance for multi-core processors.
- Internal processing and algorithmic functions in 32-bit, 64-bit, and floating point format for greater accuracy.
- Terrain altitude coloring displayed in 48-bit simulated color on standard 24-bit color monitors.
- Edit heightmaps and weightmaps using a wide number of tools.
- Digital Elevation Model (DEM) editing functions.
- Undo system.
- Context-aware help on every edit and property dialog.
- Open and save image, heightmap, digital elevation model, and mesh file formats.

World Editor

- World Editor 3D interface utilizing hardware-accelerated OpenGL.
- Create heightmap-based terrains up to 65536 × 65536 (*Professional Edition Only*).
- Create weightmap alpha masks based on heightmap properties for layering and scattering.
- Perspective and Orthogonal viewport modes.
- Aggressive terrain level-of-detail mode for sharing video memory with other software applications.
- Multiple camera types, multiple camera navigation systems, camera bookmarks.
- Master Home grid and User grids.
- Configurable lighting system.
- Designer overhead (*Professional Edition Only*).
- Scene Backdrop, Fog, Water and other visualization effects.
- Stack system.

Standard versus Professional Edition

TerreSculptor is available in a Standard Edition and a Professional Edition, with the following differences.

Standard Edition	Professional Edition
No Cost. No license required. ¹	Requires a valid license for use. ^{1 2 3 4}
262,144 unit cube World area (256k × 256k × 256k).	1,048,576 unit cube World area (1M × 1M × 1M).
Maximum 2048 × 2048 heightmap.	Maximum 65536 × 65536 heightmap.
Import/Export file formats: BMP G16 R16 TIF	Import/Export more than 80 file formats.
Texture file formats: BMP GIF JPG PNG	Texture file formats: BMP GIF JPG PNG TGA TIF
Weightmap file formats: BMP G16 PNG R8	Weightmap file formats: BMP G16 GIF PNG R8 TGA TIF
Mask file formats: BMP PNG	Mask file formats: BMP GIF PNG TGA TIF
Basic Modify tools: - Altitude (multiple tools) - Clamp - Crop - Invert - Normalize - Resample - Size - Smooth	Additional Modify tools: - Bias Gain Level - Convolution Filter - Exponent - Gaussian Blur - Interpolate - Luminance
Basic Transform tools: - Erosion (Slope, Thermal) - Flatten Edges	Additional Transform tools: - De-spike - Equalize - Erosion (Hydraulic) - Fill Region - Flood Level - Mirror - Offset - Peak Compressor - Pixelate - Planetize - Tileable
No Grids: User Grids.	Grids: User Grids.
No Layout: Designer.	Layout: Designer.
No Terrain: Stack.	Terrain: Stack.
Scene: Backdrop: - cube single color	Scene: Backdrop: - cube single color - cube gradient color - cube textured - skydome textured - skyplane textured
Scene: Water: - single color	Scene: Water: - single color - textured

¹ Software can be used for Academic, Commercial, Non-commercial, and Student use.

² Purchase price paid for a license cannot be refunded as there is no method for revoking assigned license keys.

³ The purchase price is for a license to use the software. Demenzun Media owns the software, all rights and IP.

⁴ See our website for current license pricing information.

System Requirements

- A valid software license purchased from Demenzun Media Inc. (*Professional Edition Only*).

Minimum system requirements:

- PC Compatible Computer
- 2.0GHz Dual-Core Processor
- 3GB system RAM memory
- ATI 2000 series or Nvidia 8000 series video adapter with 512MB video memory
- 17 inch or 19 inch Monitor at 1280x1024 resolution
- Keyboard and Mouse
- Windows 7, 32-bit or 64-bit version
- Microsoft dot.NET 4.5.1
- OpenGL 1.5 or greater
- 10GB or more of free hard drive space for creating worlds

Recommended system requirements:

- PC Compatible Computer
- 3.0GHz Dual-Core or Quad-Core Processor, or faster, or more cores, or hyper-threading
- 8GB system RAM memory or more, 16GB or more for large worlds
- ATI 4000 series or Nvidia GeForce 200 series or newer video adapter with 1GB video memory or more
- 24 inch Monitor at 1920x1080 or 1920x1200 resolution, or larger
- Keyboard and Mouse
- Microsoft Windows 7, 8, 8.1, or 10 64-bit
- Microsoft dot.NET 4.5.1
- OpenGL 1.5 or greater
- 10GB or more of free hard drive space for creating worlds

TerreSculptor performs best with a 3.4GHz or faster Quad-Core processor, 8GB or more system RAM, the latest high-end ATI or Nvidia video adapter with 2GB video memory, a 27 inch or 30 inch Monitor, and Windows 7 64-bit.

Note: The current builds of TerreSculptor do not have international support. The software is built and tested only on English US and English Canada localizations. TerreSculptor may not successfully run on other localizations.

Installation

The TerreSculptor application consists of a single executable file for both 32-bit and 64-bit operating systems, a configuration settings ini file, an events log file, this owner's manual reference guide pdf, and the release notes file.

TerreSculptor makes no changes to the host computer or its operating system or system registry, other than the automatic creation of its configuration settings ini file, its event log file, and a professional edition license registry setting.

Automatic Install

To automatically install the TerreSculptor software, use the installation Setup.exe or the One-Click Install.

Manual Install

To manually install the TerreSculptor software executable, create a new folder called TerreSculptor in the *C:\Program Files* folder and copy the TerreSculptor.exe or TerreSculptor Pro.exe file to this folder. Right-click on the .exe file and choose "Pin to Start menu" to create a program shortcut on the Start menu.

If you receive a Windows Security pop-up dialog when you run the software, right-click on the .exe file, choose Properties on the context menu, and on the Properties dialog click on the *Unblock* button.

Configuration Settings Ini File

The TerreSculptor.ini configuration ini file will be automatically created by TerreSculptor the first time that the executable file is ran.

The configuration settings ini file will be created in the current user account's *Application Data* folder. For Windows 7, 8, 8.1, and 10 this is located at:

```
C:\Users\<user>\AppData\Local\TerreSculptor\
```

Each Windows user account will have their own independent ini file with unique settings for that user.

Event Log File

The TerreSculptor.log event log file will be automatically created by TerreSculptor every time that the executable file is ran. The log file is located in the same user account folder as the .ini file.

Uninstall

Automatic Uninstall

Use this method if you used the automatic install.

To automatically remove TerreSculptor from a computer, launch the Windows Control Panel, choose the Uninstall a program option, locate and choose TerreSculptor in the program listing and select Uninstall.

Manual Uninstall

Use this method if you used the manual install.

To manually remove TerreSculptor from a computer:

1. Delete the *C:\Program files\TerreSculptor* folder which contains the application .exe and documentation files.
2. Delete the *C:\Users\<user>\AppData\Local\TerreSculptor* folder which contains the .ini and .log files.
3. Delete the TerreSculptor icon from the Start menu.

Overview

TerreSculptor is a three-dimensional terrain creation and editing software application designed for Windows-based PCs. You use TerreSculptor to create, edit and view professional quality heightmaps and weightmaps for use in video games, film, and geographic systems.

The TerreSculptor application presents all of the functions that you require in a single unified interface workspace. The standard Windows design and layout of menus and toolbars provides quick access to the commands and functions that you will use the most. The tab-based function area contains a rich interface to the tools for manipulating objects in your world scene.

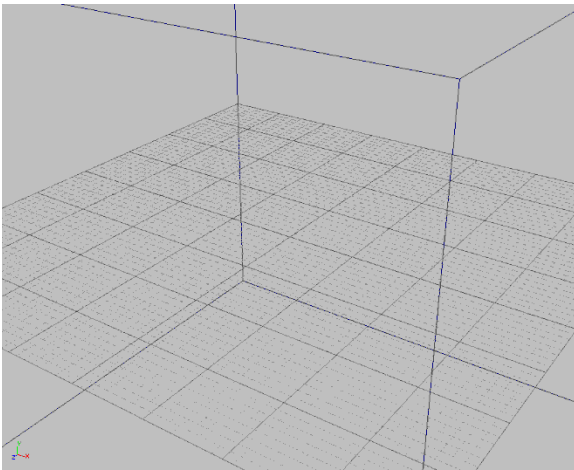
World Space and Object Space

TerreSculptor uses two specific coordinate systems called *World Space* and *Object Space*.

World Space

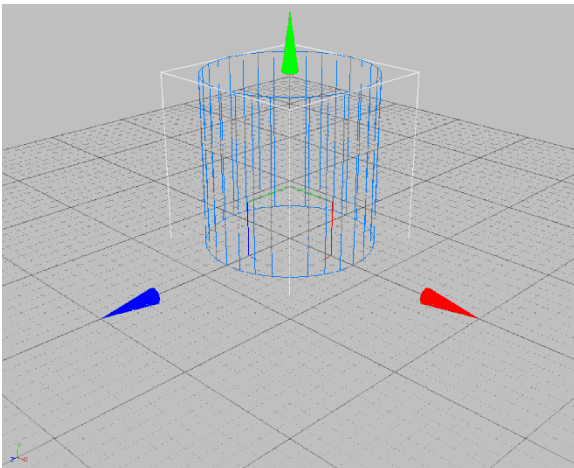
World Space is the global coordinate system that defines the location of all objects in the scene. The World Extents bounding cube and Home Grid show the world space coordinate system and its extents. World Space is always constant and never moves.

TerreSculptor defines the world space extents as a cube that is an equal number of world units in width, length, and height. Enabling the Scene World Extents helper will display the world bounding cube.



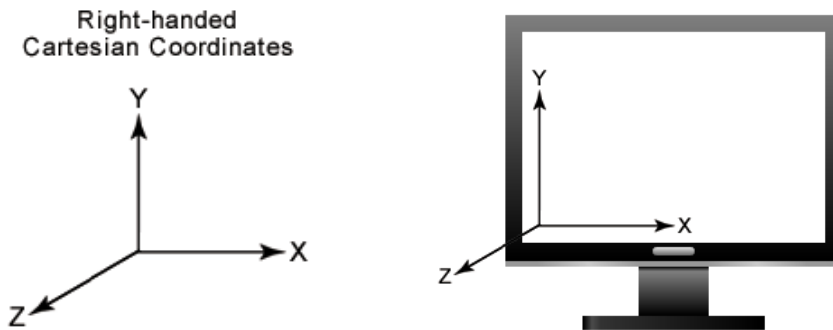
Object Space

Object Space is the coordinate system that is unique or *local* to each object in the scene. Object Space defines the local rotation and scale of each object. After any rotation and scale is applied, objects are then translated (moved) to the World Space to their final viewed location.





TerreSculptor uses the default OpenGL world coordinate system, which is commonly known as *Y-Up Right-handed Cartesian Coordinates*. The Y axis is positive upward, the X axis is positive to the right, and the Z axis is positive out of the screen.



This is similar to a flat 2D paper on the computer screen where X is the paper width left-to-right, and Y is the paper height up-and-down. Z would be moving the paper closer towards you or further away from you.

See the chapter on Coordinate Systems for additional information.

Working with Objects

In TerreSculptor, the term *object* refers to an item in the world scene. There are a wide variety of objects available including the terrain, cameras, lights, grids, backdrop and water. Each object has a variety of properties including its world location, color, size, etc.

Cameras: Provide a view into the scene. Multiple camera types and navigation styles are supported in addition to camera bookmarks.

Lights: Provide realistic scene lighting including brightness and color. There is one fixed ambient light and one moveable directional light available.

Grids: A fixed-position Home Grid and multiple user-configurable User Grids provide visual delineation of the world dimensions and locations.

Terrain: Provides a fixed-position 3D representation of the underlying heightmap data.

Backdrop: Provides a fixed-position background to the world scene for a more realistic scene view.

Water: A fixed-position sizeable translucent water plane located at the mid-altitude point in the world scene.

Basic Object Properties

All objects have a set of common basic properties, such as their local pivot point and their world location. Some objects include additional properties such as color, rotation and scale.

Parameters

The object parameters describe the size and shape of the object. For some of the objects the number of editable parameters vary, for example one object may only allow setting its color, whereas another object may allow setting its color, size, rotation, and location.

Each set of object parameter values can be specified in the edit dialog for that object.

Pivot Point

Every object in the scene has a pivot point that identifies the local center and orientation of the object. The pivot

point is the origin of the object's *local coordinate system*; it is the center of the object's rotation and scaling; and it is the center of the object's location in *world space*. Some objects have a fixed pivot point origin in world space while others can be modified.

Bounding Box

The bounding box is the cubic volume that completely encloses an object. Some of the object bounding boxes can be displayed in the scene while others are always invisible.

Transforming Objects

A transform is a 3D manipulation of an object's local coordinate system. The local coordinate system of an object is contained in a matrix of values that specify: the rotation of the object about its pivot point; the scale of the object along its local axes; and the position of the object's center in world space.

The object matrix is called the transformation matrix and its information relates directly to the transforms of Rotate, Scale, and Translate (move to location).

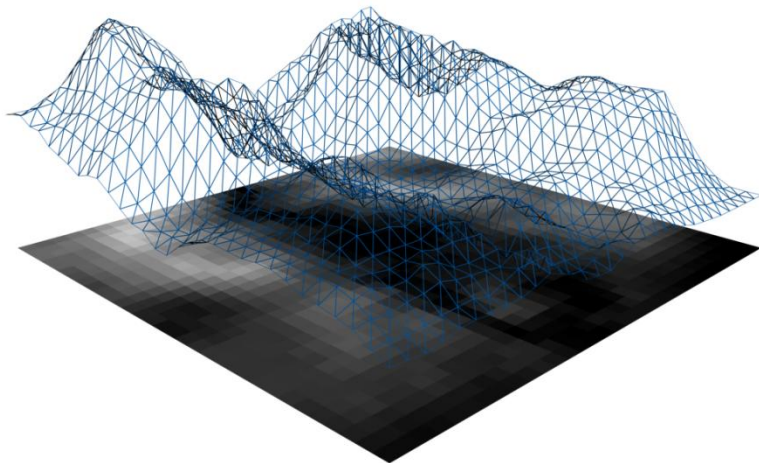
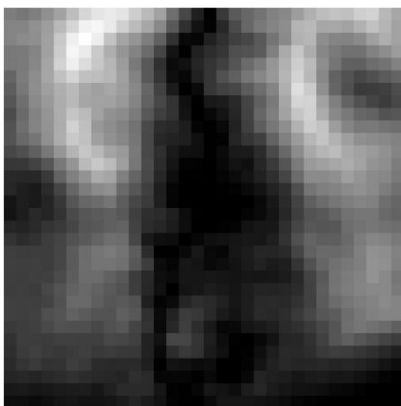
Some objects have one or more fixed transformations in the scene, preventing them from being moved or rotated.

Note: Object transform is not to be confused with the Heightmap Transform functions which perform geographic transformations on the heightmap data.

Heightmaps

A heightmap is a rectangular array of numeric data representing the altitudes for a terrain mesh. Heightmaps can appear to be similar to a grayscale image, however, each of their sample points contain altitude information instead of grayscale pixel information. Darker color values are lower altitude while lighter color values are higher altitude. Heightmaps are typically 16-bit sample data representing 65536 possible discrete altitudes. Under normal circumstances 8-bit data will not be used for heightmaps since that is only 256 discrete altitude values. Standard paint software cannot properly edit 16-bit grayscale files. TerreSculptor manages heightmap data internally as 32-bit floating point values for high accuracy.

Example: A simple low resolution heightmap and its resulting equivalent mesh. Each heightmap value corresponds to a mesh vertex. Larger numerical heightmap values (lighter gray colors) are higher mesh altitudes.



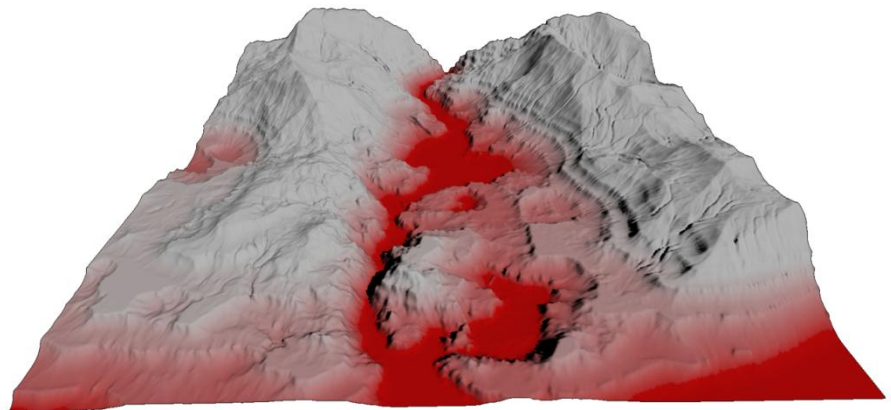
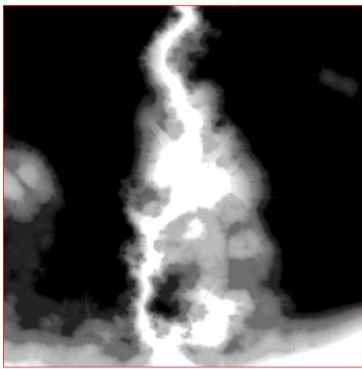
Weightmaps

A weightmap is an 8-bit grayscale *mask* or *alpha* image that represents the layout of some type of object that is overlaid on a heightmap. The overlaid object may be a texture or material shader, the area placement information for grass meshes, or other meaningful data as required by the game engine. Weightmap information can be algorithmically extracted from heightmap data for such features as by-altitude, by-slope, by-direction, by-flow, etc. A weightmap is typically the same rectangular dimensions of width and length as its source heightmap. Weightmaps, like masks, are typically 8-bit data and can be created and/or edited as a standard 8-bit grayscale image in paint software.

A weightmap is essentially the same as a mask, but by a different name in order to differentiate its functionality, and to prevent confusion as to its purpose. For example, a mask can be used within a shader to mix two textures together, which is then overlaid on a heightmap according to the content of a weightmap.

Example left: An algorithmically generated weightmap from the lower altitude range of a heightmap. Like a standard alpha mask, the pixels of black are typically treated as 0%, the pixels of white are typically treated as 100%, and the pixel values in between are the alpha gradient translucency.

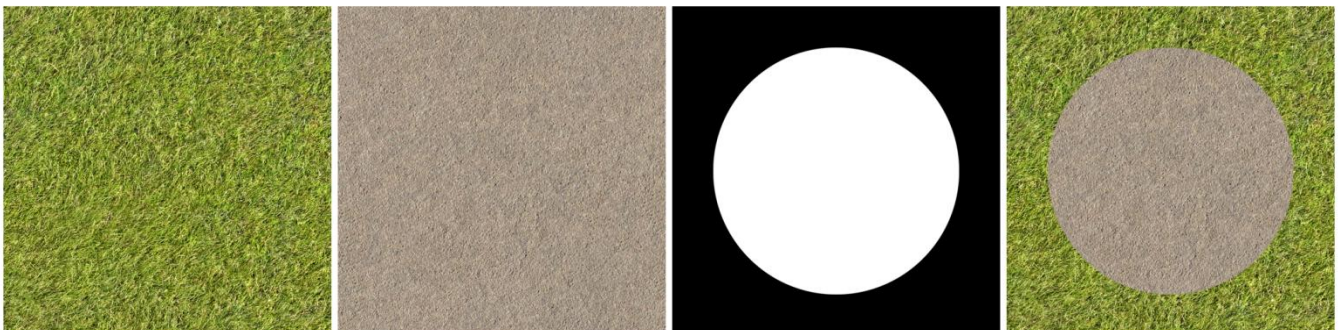
Example right: The source heightmap with the weightmap used for the red color layer control. Areas of weightmap black (0) are not changed, areas of weightmap white (255) are tinted solid red, and weightmap values in between are a gradient red based on the pixel strength. In this example, this weightmap could be used for applying a river bed texture.



Masks

A mask is an 8-bit grayscale *alpha* image that is typically used to blend between two other images or sets of data. Masks are typically 8-bit data and can be created and/or edited as a standard 8-bit grayscale image in paint software.

Example: A grass texture and dirt texture are blended using a mask. Where the mask value is 0, grass is shown; where the mask value is 255, dirt is shown; for all values in between, the two textures are blended based on the mask value weight.

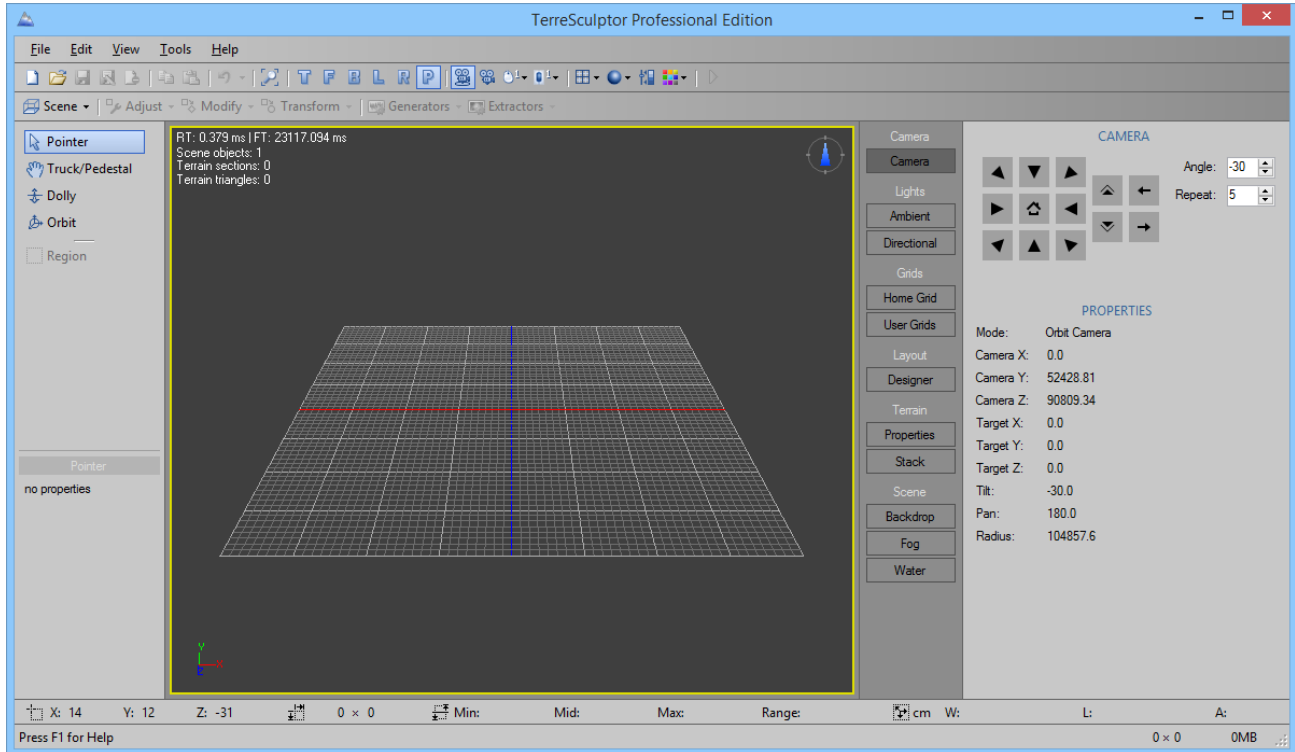


Launching TerreSculptor

After you have installed TerreSculptor on your computer, you launch it by double-clicking the TerreSculptor icon created during installation, typically found on the Windows Start menu. You can also use other standard Windows methods to launch TerreSculptor such as double-clicking the .exe executable file in Windows Explorer.

When TerreSculptor launches, the main application window appears on your desktop as shown below. The main interface design uses standard Windows controls and design conventions.

TerreSculptor is a single document application and therefore only one scene can be open at any time. Multiple copies of the software can run simultaneously on the same computer, although this is not recommended as the software requires a large amount of system resources.

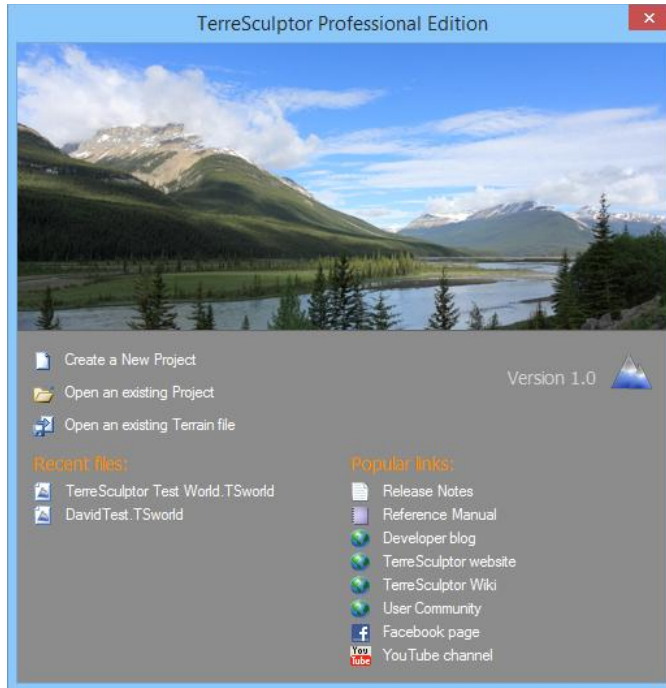


The Welcome Dialog

The Welcome dialog is optionally displayed on application startup and contains a number of quick links to common application functions. These links include starting a new project, importing an existing file, all of the recent project files, and links to documentation and popular internet sites related to the software.

The application edition is shown on the dialog title.

The application version is shown on the dialog right, as the major and minor version value.



Click on a link to choose that action.

Click on the close button on the top-right corner of the dialog to cancel or close it.

The Welcome dialog is displayed on application startup by default.

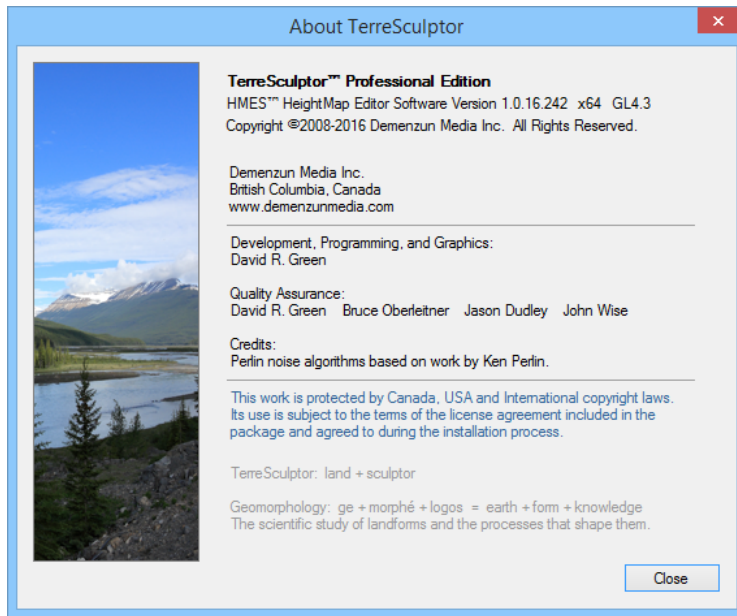
This behavior can be changed through the application Settings on the General tab Startup group.

Startup

Show Welcome dialog on startup

The About Dialog

The About dialog, located on the Help menu, contains the general information about the software including the Edition, Version number, Development credits, and Copyright information.



The TerreSculptor Interface

When TerreSculptor is launched you are presented with the main World Editor 3D interface. The world editor interface is similar to other 3D modeling software applications and is used to create and edit terrain systems targeted for video game development. The user-interface follows Windows guidelines for layout and functionality to provide a more intuitive experience.

The software window has six main areas: the Menu bar, the Toolbars, the Toolbox, the Viewport, the Function tab panels, and the Status bars.

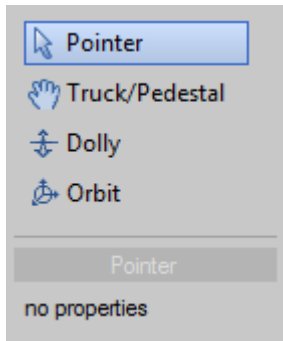
Menu bar – Contains functions for opening, saving and editing files, in addition to setting application options.



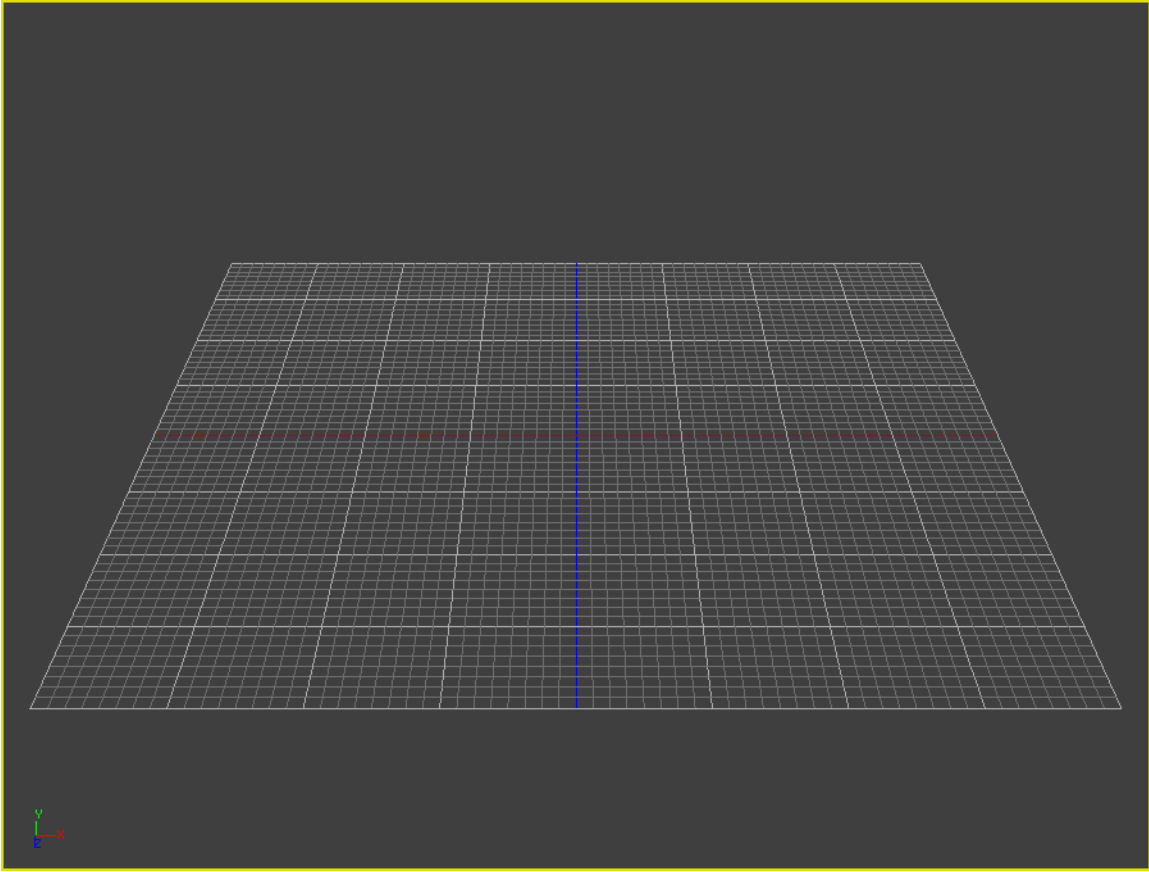
Toolbars – Contains functions that mirror many of the Menu functions, plus tools for viewport control and editing.



Toolbox – Contains functions for viewport camera control.

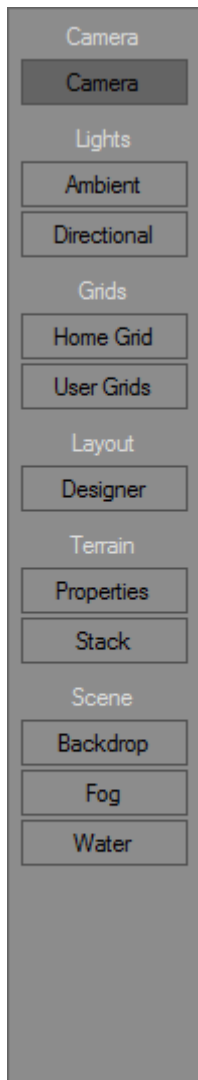


Viewport – Allows viewing and editing the objects in the world.



Function tabs – Provide access to the world scene objects and tools.

Professional Edition shown below:



Status bars – Display current application status.



Special Controls

TerreSculptor's user interface includes a number of specially designed controls for managing specific value input types or data display formats.

Angle Control



The angle control is available in two styles: a 360° version and a 90° version.

This control can only be used with the mouse. A numeric up/down control will be located next to the angle control to allow for keyboard input or alternate mouse input.

When the mouse is hovering over the angle control, the mouse cursor changes to a cross “+” shape.

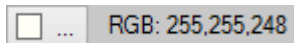
Press and hold the left mouse button to capture the mouse with the angle control.

Move the mouse around the control to adjust the angle indicator line.

The indicator line will always move to point towards the current mouse cursor location on the screen.

The current angle value will be shown in the numeric up/down control associated with the angle control.

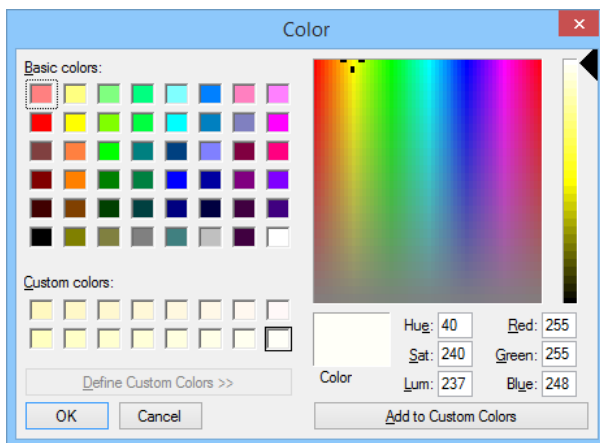
Color Button Control



The color button control is used for choosing colors from the Windows Color common dialog.

The color button control displays the current color as a square swatch and the color RGB numeric values.

Clicking on the color button control will pop up the Windows Color common dialog, where a new color value can be chosen. The Windows Color common dialog's Custom colors swatches will often contain colors relevant to the item that is being colored.



Information Bubble Control



The information bubble control displays a pop-up bubble tip with information specific to the item where the information bubble control appears.

Hover the mouse cursor over the information bubble image to display the pop-up bubble tip.

Numeric Up/Down Control



The numeric up/down control adds additional functionality to the standard Windows control of the same type.

Mouse Wheel Increment

When the numeric up/down control has the focus, and *only* when the mouse cursor is hovering over the control, the Mouse Wheel will increment or decrement the current numeric value by 3 for each wheel turn detent. The amount of increment and decrement per detent can be adjusted in the Windows Control Panel's Mouse Settings for Wheel Scrolling.

Large Increment

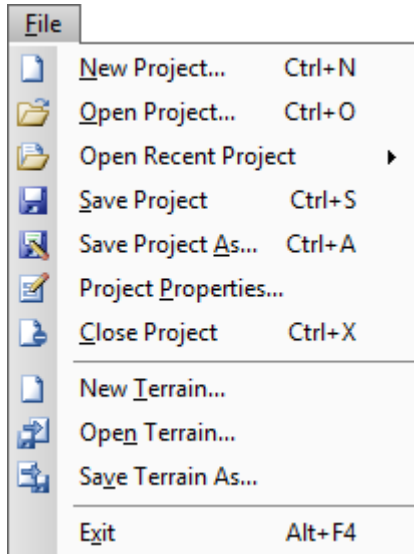
When the numeric up/down control has the focus, using the Page Up and Page Down keys will increment or decrement the current value by the large increment amount. The large increment amount defaults to an increment or decrement amount of 10. Some object properties will use a larger increment value such as 1024.

The Menu bar

File Edit View Tools Help

The menu bar contains several categories of commands including standard Windows application operations.

File Menu



New Project – closes any current project and starts a new project, resets most project properties to default.

Open Project – open an existing project file.

Open Recent Project – re-open a recently opened project file from the menu list.

Save Project – save the current project to a project file.

Save Project As – save the current project with a specified project file name.

Project Properties – display the current project file properties dialog.

Close Project – close the current project.

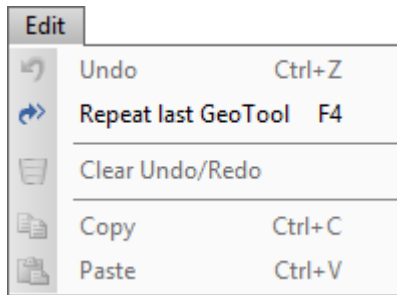
New Terrain – creates a new terrain, replaces any current terrain, retains any current project properties.

Open Terrain – open a terrain file (DEM, heightmap, image, or mesh) into the current project.

Save Terrain As – save the project terrain to a file (DEM, heightmap, image, or mesh).

Exit – exit the application.

Edit Menu



Undo – undo the last operation.

Undo currently only undoes a specific set of actions. Not all application actions or changes can be undone by this menu item. See the chapter on Undoing Changes.

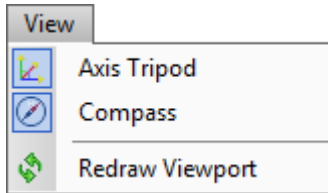
Repeat last GeoTool – the last immediate mode GeoTool that was accessed will be opened with its last settings.

Clear Undo/Redo – clear the undo and redo list and delete all undo and redo temporary files.

Copy – copy the current object to the Windows clipboard.

Paste – paste the contents of the Windows clipboard to the current object.

View Menu

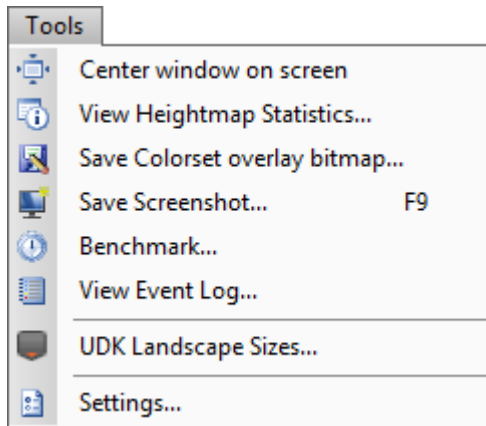


Axis Tripod – toggle the editor viewport axis tripod visibility.

Compass – toggle the editor viewport compass icon visibility.

Redraw Viewport – redraw the viewport scene.

Tools Menu



Center window on screen – center the application window on the screen.
This properly handles multi-monitor setups.

View Heightmap Statistics – view the statistics for the selected stack heightmap.

Save Colorset overlay bitmap – save the terrain mesh colorset as an image file.

Save Screenshot – save the current contents of the viewport as an image file.
This function is valid for all orthogonal and perspective views.

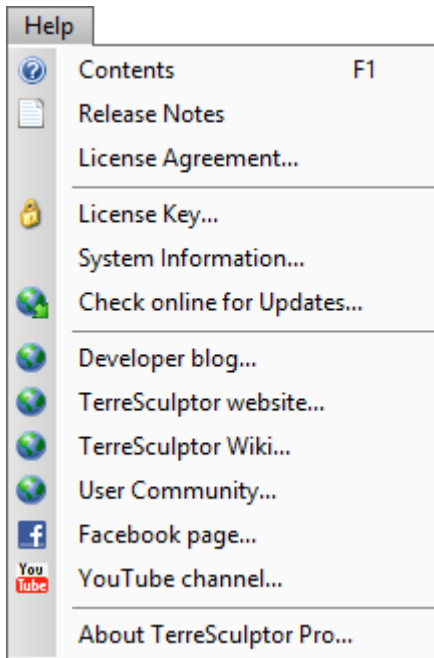
Benchmark – run a computer system performance benchmark.
See the chapter on *Benchmarking System Performance*.

View Event Log – View the application event log file contents.
See the chapter on *Application Event Logging*.

UDK Landscape Sizes – launch the UDK 3 Landscape Sizes dialog.
See the chapter on the *UDK Landscape*.

Settings – display the application settings dialog.
Information on the Settings is provided in another chapter in this document.

Help Menu



Contents – display the application reference manual file.

Release Notes – display the application release notes file.

License Agreement – display the software license agreement.

License Key – display or change the license key (*Professional Edition Only*).

System Information – display the system information dialog.

Check online for Updates – check the Internet for application updates and new versions.

Developer blog – connect to the developer blog site.

TerreSculptor website – connect to the software main website.

TerreSculptor Wiki – connect to the software wiki site.

User Community – connect to the software user community forums.

Facebook page – connect to the software Facebook web page.

YouTube channel – connect to the software YouTube channel for video tutorials.

About TerreSculptor [Pro] – display the about and copyright dialog.


The Toolbars


The toolbars provide quick *one-click* access to many of the common functions found on the menus. The toolbars also contain additional application functions that are not available on the menus.


Main Toolbar





 **New Project** – closes any current project and starts a new project.

 **Open Project** – open an existing project file.


 **Save Project** – save the current project.

 **Save Project As** – save the current project with a specified file name.


 **Close Project** – close the current project.

 **Copy** – copy the current object to the Windows clipboard.

 **Paste** – paste the contents of the Windows clipboard to the current object.

 **Undo** – undo the last operation.
This is a drop-down menu that lists the ordered undo actions.

*Undo currently only undoes a specific set of actions.
Not all actions or changes can be undone by this button item.
See the chapter on Undoing Changes.*

 **Zoom Extents** – zoom the viewport to the extents of the current terrain.
This will zoom only to the extents of the current terrain. If no terrain is loaded then this will have no effect. If any scene objects lie outside of the current terrain area, this will not zoom to encompass them.


 **Top** – select the viewport top orthogonal view.


 **Front** – select the viewport front orthogonal view.

 **Back** – select the viewport back orthogonal view.

 **Left** – select the viewport left orthogonal view.

 **Right** – select the viewport right orthogonal view.

 **Perspective** – select the viewport perspective view.

 **Orbit Camera** – select the orbit camera.
See the Viewport Cameras chapter for camera movement information.
The camera selection can also be assigned to one of the mouse X-buttons in the application Options.



Free Camera – select the free movement camera.

See the Viewport Cameras chapter for camera movement information.

The camera selection can also be assigned to one of the mouse X-buttons in the application Options.



Mouse Speed – camera mouse speed multiplier.

This is a drop-down menu that contains the available mouse speed multipliers.

The mouse speed can also be assigned to one of the mouse X-buttons in the application Options.



Mouse Wheel Speed – camera mouse wheel speed multiplier.

This is a drop-down menu that contains the available mouse wheel speed multipliers.

The mouse wheel speed can also be assigned to one of the mouse X-buttons in the application Options.



LOD – render the terrain mesh using multiple level-of-detail modes.

This is a drop-down menu that contains the available LOD modes.

See the Terrain LOD Modes chapter.



Render Mode – render specific scene objects as wireframe, faceted, or smoothed triangles.

This is a drop-down menu that contains the available render modes.

The scene objects that support multiple render modes include the backdrop, terrain, and water.



Auto-range Colorset – render the terrain mesh using the auto-range version of the specified colorset.

Auto-range colorsets follow the current altitude range of the terrain and do not change based on Y position.



Colorset – render the terrain mesh using the specified colorset.







This is a drop-down menu that contains the available color sets.



Animate – toggle the rotational animation of the Orbit Camera.

Edit Toolbar

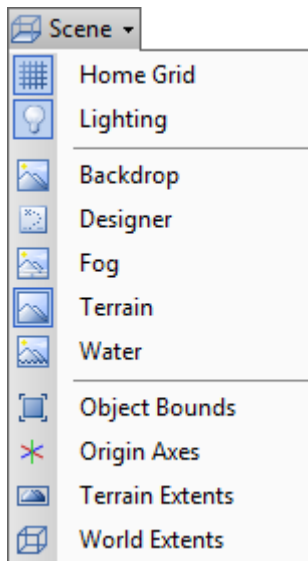


-  **Scene drop-down menu** – contains menu items for managing the scene. The menu items are discussed in the following sections.
-  **Adjust drop-down menu** – contains menu items for adjusting the terrain heightmap. These items perform *immediate mode* changes. The menu items are discussed in the following sections.
-  **Modify drop-down menu** – contains menu items for modifying the terrain heightmap. These items perform *immediate mode* changes. The menu items are discussed in the following sections.
-  **Transform drop-down menu** – contains menu items for transforming the terrain heightmap. These items perform *immediate mode* changes. The menu items are discussed in the following sections.
-  **Generators drop-down menu** – replaces the contents of the terrain heightmap with the specified noise. This item performs *immediate mode* changes. See the Noise Generator chapter.
-  **Extractors drop-down menu** – creates a weightmap mask based on the current terrain heightmap data. This item performs *immediate mode* changes. The weightmap mask data can be saved to disk in the dialog. See the Extractors chapter.

Scene Drop-down Menu

This menu contains scene objects that can be enabled or disabled. All of these scene objects are available at all times, including when a terrain is not loaded.

See the *Scene Objects and Helpers* chapter for information on each tool.



Home Grid – toggle the visibility of the home grid.

Lighting – toggle the scene lighting.

Backdrop – toggle the visibility of the scene backdrop.

Designer – toggle the visibility of the scene designer plane (*Professional Edition Only*).

Fog – toggle the visibility of the scene fog effect.

Terrain – toggle the visibility of the scene terrain.

Water – toggle the visibility of the scene water.

Object Bounds – toggle the visibility of the object bounding boxes.

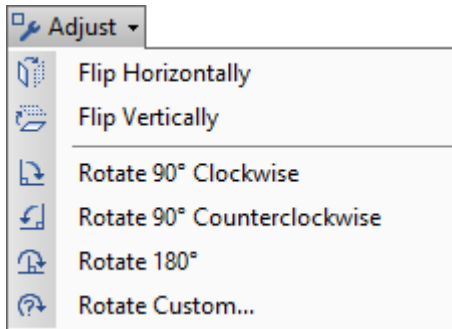
Origin Axes – toggle the visibility of the colored origin axes lines.

Terrain Extents – toggle the visibility of the terrain extents bounding box.

World Extents – toggle the visibility of the world extents bounding box.

Adjust Drop-down Menu

This menu contains a number of immediate mode *GeoTool* editing functions that change the terrain heightmap. See the *Heightmap GeoTools* chapter for information on each tool.



Flip Horizontally – flip the terrain heightmap horizontally.

Flip Vertically – flip the terrain heightmap vertically.

Rotate 90° Clockwise – rotate the terrain heightmap 90 degrees clockwise.

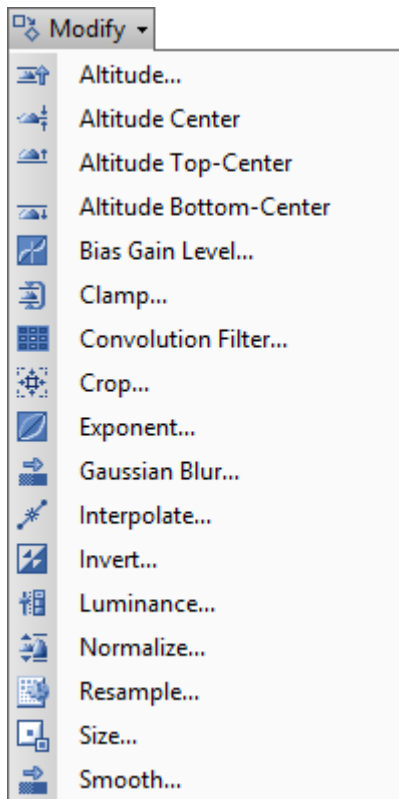
Rotate 90° Counterclockwise – rotate the terrain heightmap 90 degrees counter-clockwise.

Rotate 180° – rotate the terrain heightmap 180 degrees.

Rotate Custom – rotate the terrain heightmap by a specified degrees amount.

Modify Drop-down Menu

This menu contains a number of immediate mode *GeoTool* editing functions that change the terrain heightmap. See the *Heightmap GeoTools* chapter for information on each tool.



Altitude – adjust the altitude of the terrain heightmap.

Altitude Center – move the terrain heightmap to the center altitude.
The heightmap will be positioned with its median value at the center Y coordinate.

Altitude Top-Center – move the terrain heightmap to the top-center altitude.
The heightmap will be positioned with its lowest altitude value at the center Y coordinate.

Altitude Bottom-Center – move the terrain heightmap to the bottom center altitude.
The heightmap will be positioned with its highest altitude value at the center Y coordinate.

Bias Gain Level – adjust the altitude of the terrain heightmap.
Bias = modify gain above and below the specified center point.
Gain = modify overall gain.
Level = move the terrain heightmap up and down the Y value.

Professional Edition Only

Clamp – clamp the altitude limits of the terrain heightmap.

Convolution Filter – apply a variety of spatial filters to the terrain heightmap.
Professional Edition Only

Crop – crop the terrain heightmap to a smaller size.

Exponent – apply an exponent and multiplier to the terrain heightmap.
Professional Edition Only

Gaussian Blur – apply a gaussian blur to the terrain heightmap.
Professional Edition Only

Interpolate – interpolate the terrain heightmap to a larger resolution.

Professional Edition Only

Invert – invert the terrain heightmap altitudes.

Luminance – adjust the brightness, contrast, and gamma of the terrain heightmap.

Professional Edition Only

Normalize – adjust the terrain heightmap to its maximum altitude limits.

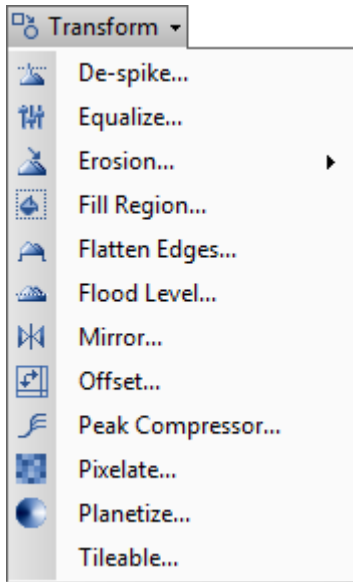
Resample – change the resolution of the terrain heightmap.

Size – change the total size of the terrain heightmap while retaining the original heightmap dimensions. This adds additional space around the perimeter of the current terrain heightmap.

Smooth – apply smoothing to the terrain heightmap.

Transform Drop-down Menu

This menu contains a number of immediate mode *GeoTool* editing functions that change the terrain heightmap. See the *Heightmap GeoTools* chapter for information on each tool.



De-spike – remove single vertex spikes on the terrain heightmap.
Professional Edition Only

Equalize – adjust the equalization of the terrain heightmap.
Professional Edition Only

Erosion – apply erosion algorithms on the terrain heightmap.
The Erosion fly-out menu includes the current erosion algorithms: Hydraulic, Slope, Thermal

Fill Region – fill the specified XZ region with the specific Y altitude value.
Professional Edition Only

Flatten Edges – flatten the outer edges of the terrain heightmap.

Flood Level – simulated flooding of the terrain heightmap.
Professional Edition Only

Mirror – mirror the terrain heightmap to one of the four sides, typically for symmetrical map designs.
Professional Edition Only

Offset – offset the terrain heightmap along the width and length.
Professional Edition Only

Peak Compressor – compress the upper altitude peaks of the terrain heightmap.
Professional Edition Only

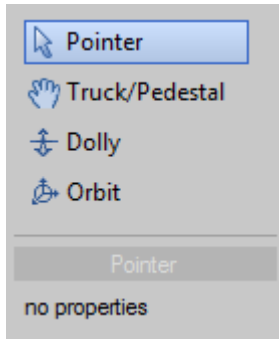
Pixelate – pixelate the XY on the terrain heightmap.
Professional Edition Only

Planetize – curve the surface of the terrain heightmap.
Professional Edition Only

Tileable – make the terrain heightmap tileable by blending its edges.
Professional Edition Only

The Toolbox

The Toolbox, always located on the left side of the main viewport, contains toolbox buttons and properties for controlling and manipulating a variety of viewport functions. These functions include camera control.



Pointer – default camera mode.
Available for all cameras.

Truck / Pedestal – truck (move left-to-right) and pedestal (move up-and-down) the camera.
Often incorrectly called Pan.
Available for the Free camera only.

Dolly – dolly the camera (move in-and-out or towards-and-away).
Available for all cameras.

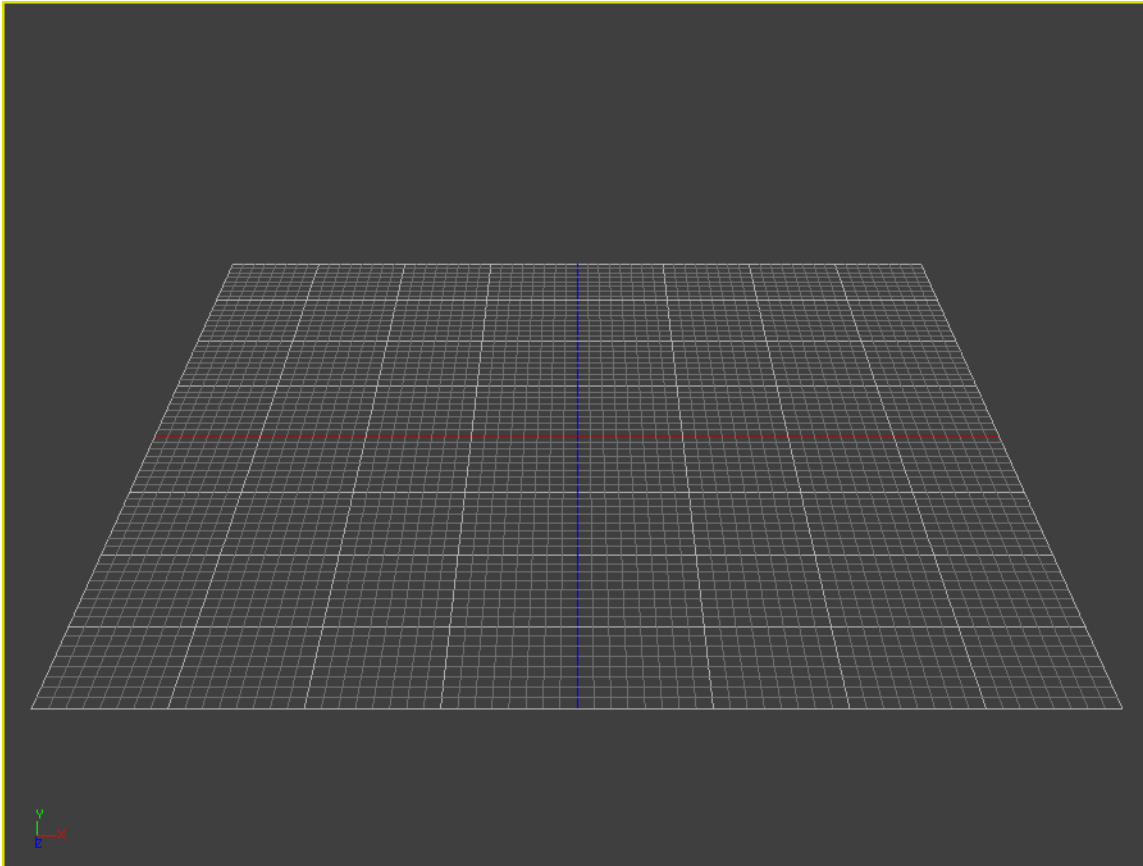
Orbit – spin (orbit) and pitch the Orbit camera; free-look the Free and WASD cameras.
Available for all cameras.

The Main Viewport

The main viewport is a view into the three-dimensional space of the world scene. While creating a world scene, the viewport provides a dynamic view of the world construction data and scene objects.

The viewport view is always through a default camera. With this viewport camera, the scene can be moved, panned, and zoomed. The viewport camera supports two different movement modes, orbit and free. The camera is moved around the scene using a variety of mouse movements, mouse button combinations, and the mouse wheel, as listed in the shortcut options.

The viewport is active when its focus border is highlighted. The default highlight color is light yellow. The viewport must be active for camera movement to occur. To make the viewport active, click on it anywhere.





Viewport Cameras

Navigating the scene through the main viewport is accomplished by moving the camera. Two different camera movement modes are supported, orbit and free, which use a combination of mouse movements, mouse buttons, the mouse wheel, and camera toolbar buttons.

Each camera movement mode is fully independent, with each retaining its last world location when switching between the modes.

Two camera speed multiplier drop-down menus are provided on the toolbar to modify the speed of the mouse movement and mouse wheel. The wheel speed can also be changed by clicking the mouse wheel button.

 Changes the mouse movement speed by 1/4x, 1/2x, 1x, 2x, 4x and 8x

 Changes the mouse wheel speed by 1/4x, 1/2x, 1x, 2x, 4x and 8x

The mouse speed base setting is located in the Settings on the Viewports tab in the Mouse group. The speed range is from 1 (slow) to 100 (fast) with a default value of 50.

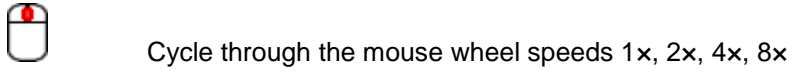
Mouse

Mouse speed:

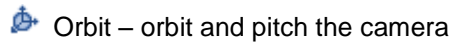
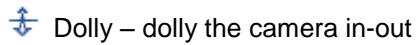
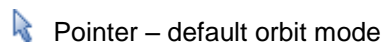
Mouse wheel speed:

Orbit Camera

The orbit camera moves in a circle around the scene with its camera target always fixed looking at the scene world origin at 0,0,0.

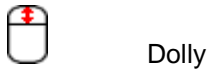
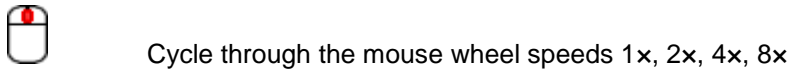


Additional fixed-function *left mouse button + mouse movement* camera modes are available on the toolbox as:

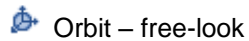
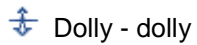
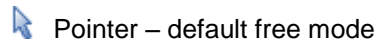


Free Camera

The free camera provides complete freedom of movement on any scene axis to any location and position in the scene.



Additional fixed-function *left mouse button* + *mouse movement* camera modes are available on the toolbox as:

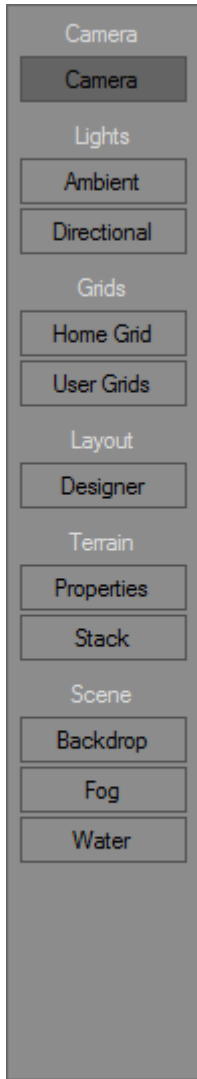


The Function Tabs

To the right of the main viewport are the Function tab selection buttons and tab panels.

The Function tab panels provide access to the scene objects including the camera, lights, grids, layout objects, terrain object, and scene objects.

Only one panel is visible at a time. The other panels are displayed by clicking on their tab selection button.



Camera – Provides controls for managing the camera position in the scene.

Lights – Provides controls for managing the lighting in the scene.

Grids – Provides controls for managing the home grid and user grids in the scene.
The User Grids are *Professional Edition Only*.

Layout – Provides controls for managing the optional designer plane features in the scene.
The Layout group and Designer are *Professional Edition Only*.

Terrain – Provides controls for managing the terrain and world stack.
The Terrain Stack is *Professional Edition Only*.

Scene – Provides controls for managing the optional backdrop, fog, and water features in the scene.

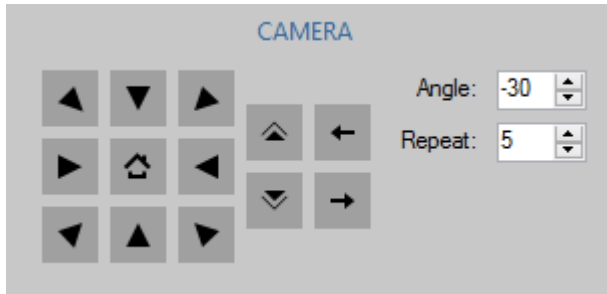
Camera: Camera

The Cam-Nav, or Camera Navigation, area of the Camera tab provides quick access to common camera locations and positions in the scene.

Orbit Camera

The Cam-Nav area for the Orbit Camera consists of the Navigation Pad and Angle/Repeat settings controls. The Navigation Pad has pads for positioning the camera at the Home location, 8 position fixed rotation pads at 45 degree angles, dolly in and dolly out pads, and two rotation clockwise and counter-clockwise direction pads.

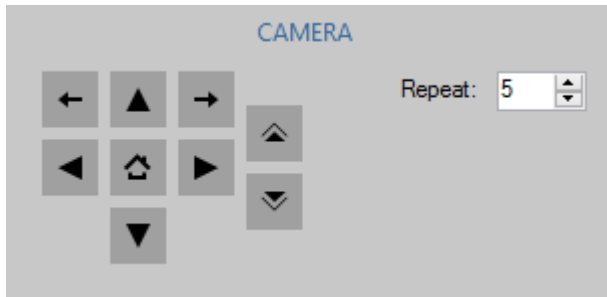
The Angle numeric control sets the angle in degrees for the fixed rotation pads.
The Repeat numeric control sets the repeat speed for the dolly and rotation pads.



Free Camera

The Cam-Nav area for the Free Camera consists of the Navigation Pad and Repeat settings controls. The Navigation Pad has pads for positioning the camera at the Home location, 4 direction pads for truck left/right and forward/backward, truck up/down pads, and two rotation clockwise and counter-clockwise direction pads.

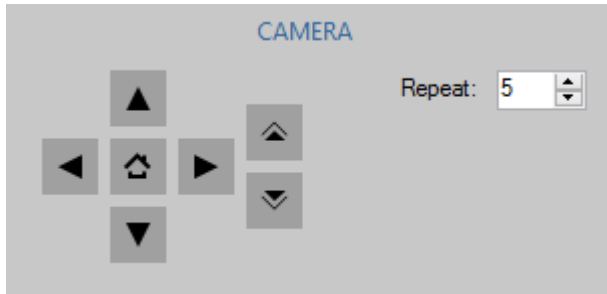
The Repeat numeric control sets the repeat speed for the truck, dolly, and rotation pads.



TFBLR Ortho Cameras

The Cam-Nav area for the Ortho Camera consists of the Navigation Pad and Repeat settings controls. The Navigation Pad has pads for positioning the camera at the Home location, 4 direction pads for truck left/right and forward/backward, and dolly in/out pads.

The Repeat numeric control sets the repeat speed for the truck and dolly pads.



Camera Properties

The Camera Properties area of the Camera tab provides the current camera positional information.

PROPERTIES	
Mode:	Orbit Camera
Camera X:	0.0
Camera Y:	51156.31
Camera Z:	88605.31
Target X:	0.0
Target Y:	0.0
Target Z:	0.0
Tilt:	-30.0
Pan:	180.0
Radius:	102312.6

Lights: Ambient

The world scene includes two light sources: an ambient light, and a directional light that simulates the sun or moon.

💡 The Lights are toggled on and off with the toolbar Scene drop-down Lighting menu item.

Ambient Light



📁 Load the original lighting settings from the application settings file.


💾 Save the current lighting settings to the application settings file.

🔄 Reset the lighting to the default settings.

Color – specify the color of the ambient light.

Lights: Directional

The world scene includes two light sources: an ambient light, and a directional light that simulates the sun or moon.


 The Lights are toggled on and off with the toolbar Scene drop-down Lighting menu item.


Directional Light



 Load the original lighting settings from the application settings file.

 Save the current lighting settings to the application settings file.

 Reset the lighting to the default settings.

 Show the directional light indicator gizmo in the viewport.

Direction – the world direction that the directional light is facing, in degrees from 0 to 359.

Angle – the pitch angle that the directional light is facing, in degrees from -90 (straight down) to 0 (horizontal).

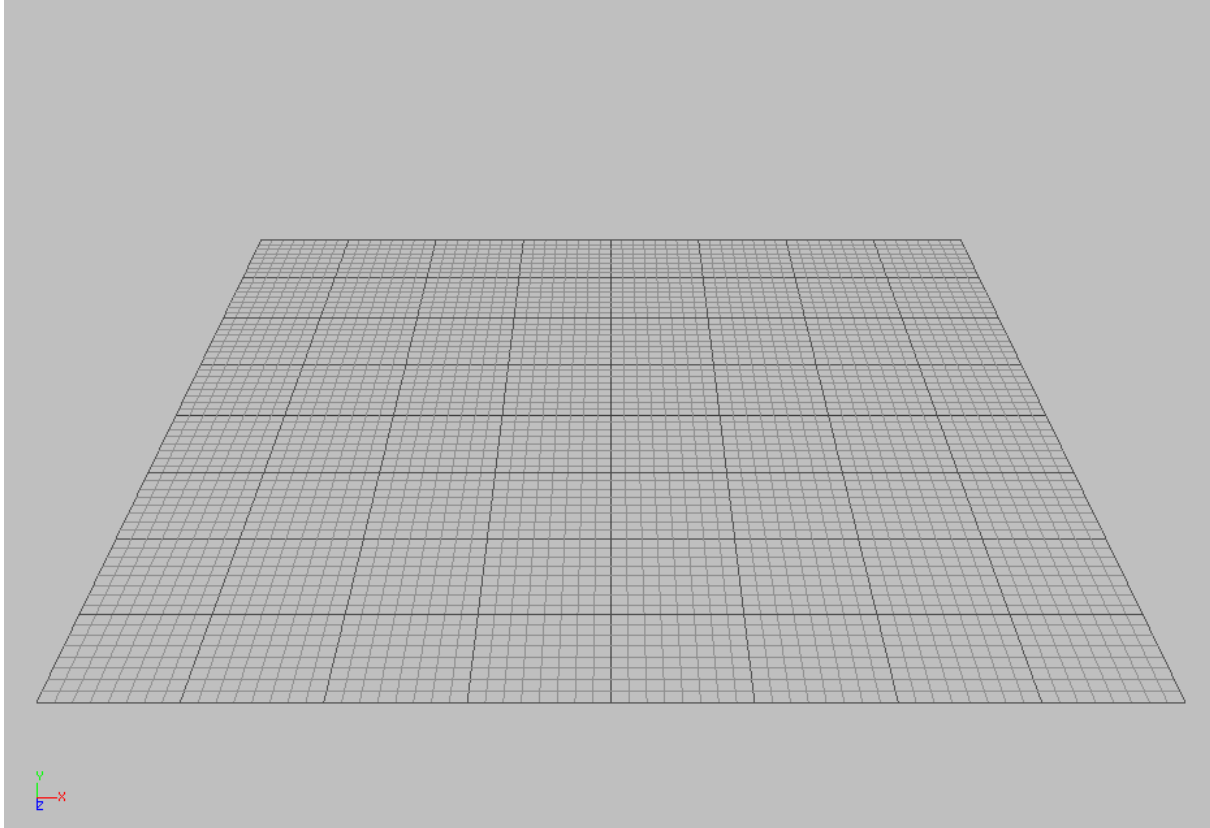
Ambient Color – specify the ambient color of the directional light. Use this to set a base shadow color.

Diffuse Color – specify the diffuse color of the directional light. Use yellows for sunlight and white-violet for moonlight.

Specular Color – specify the specular color of the directional light. Use this for flat or shiny lighting.

Gizmo length – specify the length of the directional light indicator from the world origin.

Grids: Home Grid




The home grid that you see in the viewport represents one of three planes that intersect at right angles to one another at a common point called the *origin*. Intersection occurs along three lines which are the world coordinate X, Y, and Z axes in the geometric Cartesian coordinate system.

The plane based on the world coordinate XZ axis is called the *home grid plane*, which is the base reference system of the 3D world.

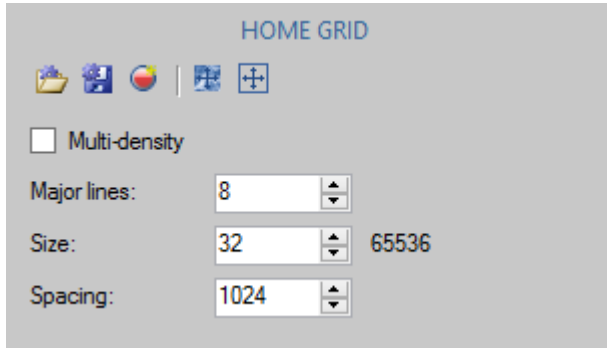
Two axes define the plane of the home grid. In the perspective viewport, you are looking across the XZ plane, with the X axis running left-to-right, and the Z axis running front-to-back. The third axis, Y, runs vertically through this plane up-and-down.






The home grid is always aligned with the world XZ coordinate axes. It can be turned on and off in each viewport view, but its orientation cannot be changed. The center of the home grid plane is always located at the world origin X,Y,Z of 0,0,0.

The home grid is not used for object snapping since all objects in the scene are always aligned on integer digit values on all three world axes.

 Choose the Home Grid item on the toolbar Scene drop-down menu to toggle the visibility of the home grid.

The home grid properties are set on the Grids tab of the Functions Tabs area.



-  Load the original home grid settings from the application settings file.
-  Save the current home grid settings to the application settings file, making them the startup settings.
-  Reset the home grid to the default settings.
-  Set the home grid spacing*size to the current terrain dimensions.
-  Set the home grid spacing*size to the world extents.

Multi-density – toggle the home grid between standard constant-spaced lines and a multiple density grid.

Multi-density is useful for reducing “grid line aliasing clutter” that occurs when viewing the scene from oblique or shallow angles, as the further out the grid is from the center origin, fewer lines are rendered.

Major lines – sets every *n*th line to be a bolder line color.

Size – specifies the number of grid lines in each of the axis directions – and + from the center origin.

The numeric value to the right of the Size control is the current home grid full extents along the X and Z axes. For example, a Size value of 32 grid lines on each side of the origin multiplied by a Spacing of 1024 world units equals: $(32 \times 2) \times 1024 =$ a 65536 world units home grid size.

Spacing – specifies the world units spacing between each grid line.

The size and spacing of the home grid can be set larger than the world extents, however, the size will be clamped back to the world extents on either a home grid re-creation or when a world file is loaded.

Options

The home grid startup and line coloring settings are located on the Settings dialog's Grid and Snap tab. See the Settings dialog chapter for information on these settings.

Grids: User Grids

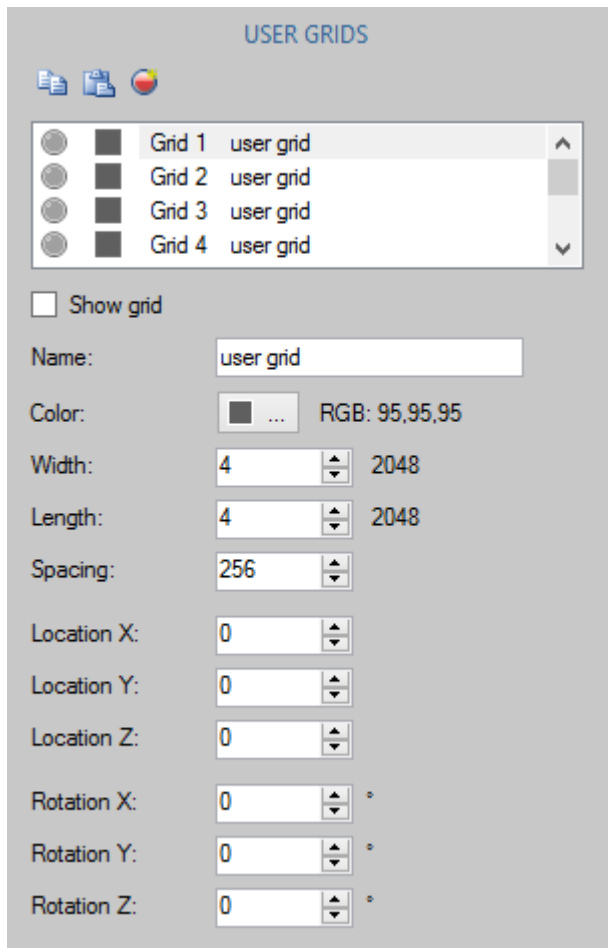
Professional Edition Only


The home grid is supplemented with eight user grids. User grids are independent grids that can be placed anywhere in the scene and rotated to any angle. User grids cannot be snapped to directly but provide a visual grid system only.


User grids can also be used to provide visual grids in the main viewport orthographic views for front, back, left and right, which only see the home grid on its flat edge axis.


To display a user grid in the scene, select one of the eight grids in the list, and check its *Show grid* option. You can then:


- Assign a custom name to the grid by typing in the Name textbox.
- Change its grid line color by clicking on the Color button and choosing another color.
- Change its size by modifying the values of its width and length and the spacing between each grid line.
- Change its location on the X, Y, and Z axes.
- Change its rotation on the X, Y, and Z axes.



 Copy the current grid settings to the clipboard.

 Paste the clipboard settings to the current grid.

 Reset the grid to the default settings.

 displays a grey or green light depending on whether the grid is currently invisible or visible.

■ reflects the current color of the grid.

Name – specify the name of the grid.

Color – specify the color of the grid lines.

The grid origin lines will always be colored using the default origin line color specified in the Options.

Width – specify the width in world unit of the grid.

Length – specify the length in world units of the grid.

Spacing – specify the spacing in world units between grid lines.

Location X – specify the grid world location on the X axis plane.

Location Y – specify the grid world location on the Y axis plane.

Location Z – specify the grid world location on the Z axis plane.

Rotation X – specify the grid rotation in degrees around the X axis.


Rotation Y – specify the grid rotation in degrees around the Y axis.

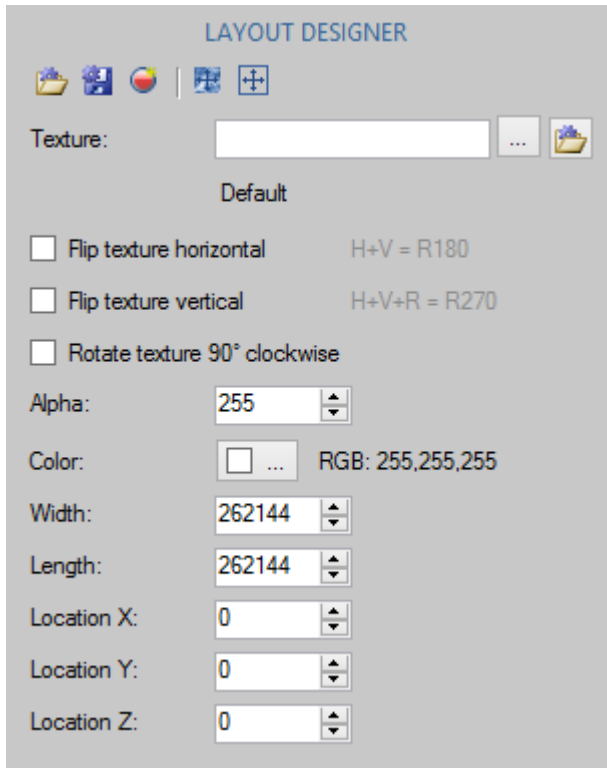
Rotation Z – specify the grid rotation in degrees around the Z axis.

Layout: Designer

Professional Edition Only


The scene designer provides a textured plane mesh that is used for displaying an overhead design map of the terrain layout. Overheads are commonly used in video game level design to depict the layout of map objects and storyboard scene events. The Designer can be used with Planner primitives and shapes to create a complete proxy layout of the final level design.


 The Designer is toggled on and off with the toolbar Scene drop-down Designer menu item.



 Load the original designer settings from the application settings file.

 Save the current designer settings to the application settings file.

 Reset the designer to the default settings.


 Set the designer spacing*size to the current terrain dimensions.


 Set the designer spacing*size to the world extents.

Texture – specify the texture file to display on the designer plane mesh.

The designer supports square-aspect, 2:1 and 1:2 width:height ratio textures only. 32-bit textures with alpha are supported.

See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.

Flip texture horizontal – flip the texture horizontally.

Flip texture vertical – flip the texture vertically

Rotate texture 90° clockwise – rotate the texture 90 degrees clockwise.

Alpha – specify the alpha transparency of the design plane mesh. This is additive with any texture alpha.

Color – specify the designer plane mesh color. Typically this will be white but other colors will tint the texture.

Width – specify the designer plane mesh width in world units.

Length – specify the designer plane mesh length in world units.

Location X – specify the designer plane mesh location along the x axis in world units.

Location Y – specify the designer plane mesh location along the y axis in world units.

Location Z – specify the designer plane mesh location along the z axis in world units.

Creating Designer Textures

Professional Edition Only

Designer textures are a square or rectangular aspect image that is typically the same dimensions or aspect as the heightmap. The texture is applied using planar UV mapping coordinates that are configured as full planar 1:1 with edge clamping. The designer Width and Length properties should be set to match the texture aspect ratio.

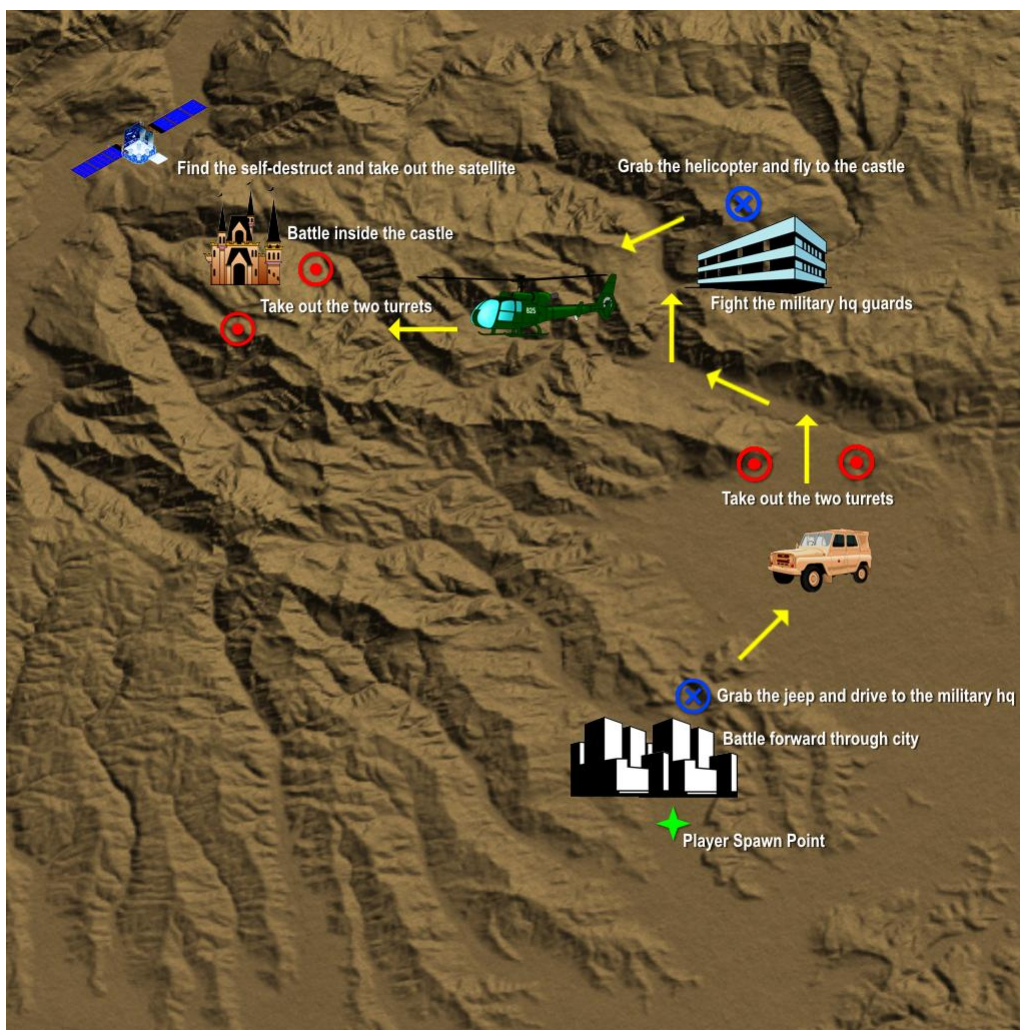
The texture is applied to both the top and the bottom of the designer plane mesh, with the bottom UV mapping set to mirror the top so that it appears like looking through the plane mesh.

The texture may contain alpha channel information to provide areas of translucency or transparency.

Designer textures are typically used for level designer storyboard overheads and map layout guidelines. The information contained on the texture can be used to determine heightmap design layout, such as where mountains or rivers are located, or to depict the storyboard events and their locations on the terrain.

A top view screenshot of the terrain can be saved to use as a reference guide for placing the various storyboard elements. The completed designer texture can be checked against the final heightmap, and all terrain assets passed to the level design department.

An example designer storyboard texture.



Terrain: Properties

The terrain properties tab contains terrain mesh rendering properties and terrain statistics.

TERRAIN PROPERTIES

XZ spacing: 256

Y spacing: 256

Y scale: 256

Show detail texture

Detail tiling: 1

Show overlay texture

Texture: ...

Debug mode

Statistics:

Item	Value

XZ spacing – The terrain mesh X and Z axis vertex spacing, in world units.

Y spacing – The terrain mesh Y axis vertex spacing, in world units.

Y scale – The terrain mesh Y axis vertex scale, this is fixed to the value in the Settings, Ruler and Units, Units.

Show detail texture – Whether to show the tiling detail texture on the terrain mesh.

Detail tiling – The detail texture tiling multiplier.

The value is the number of times to tile the detail texture across each terrain quad.

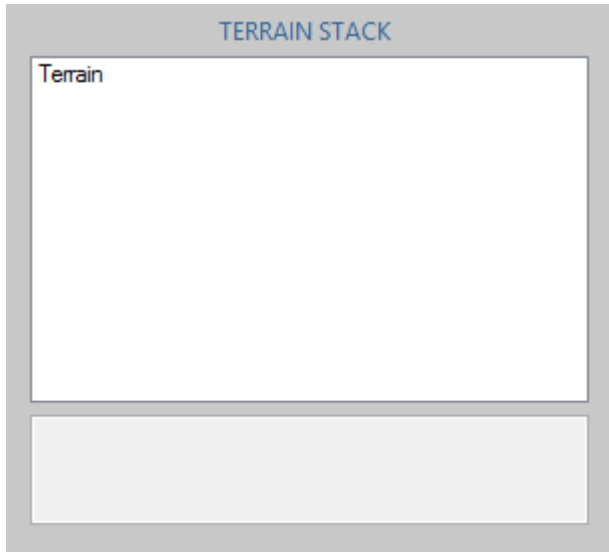
Debug mode – Renders each terrain section in a different tinted color.

Statistics – Displays the terrain mesh statistics.

Click on the Refresh button to update the statistics information.

Terrain Stack

A listing of objects in the terrain stack tree.
Currently this list contains only the main terrain mesh object.



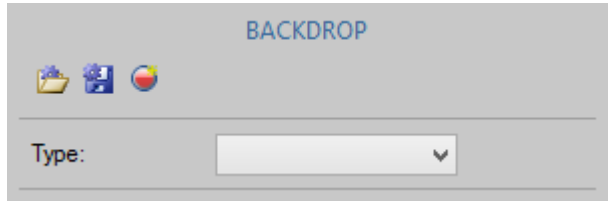
Scene: Backdrop

The scene backdrop is an optional visualization mesh that is used to simulate a sky surrounding the terrain mesh.



The Backdrop is toggled on and off with the toolbar Scene drop-down Backdrop menu item.

The following are the properties common to all Backdrop types:



Load the original backdrop settings from the application settings file.



Save the current backdrop settings to the application settings file.



Reset the backdrop to the default settings.

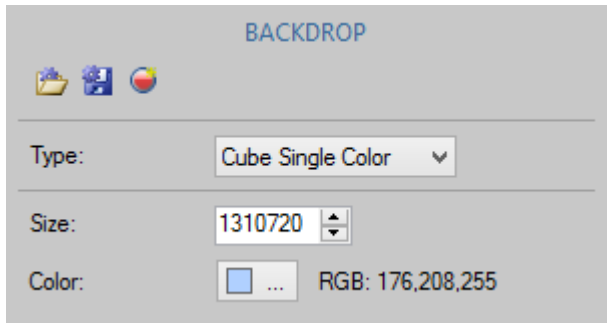
Type – specify the scene backdrop type.

There are five different backdrop types in the *Professional Edition*.

There is one backdrop type available in the Standard Edition.

Scene: Backdrop: Cube

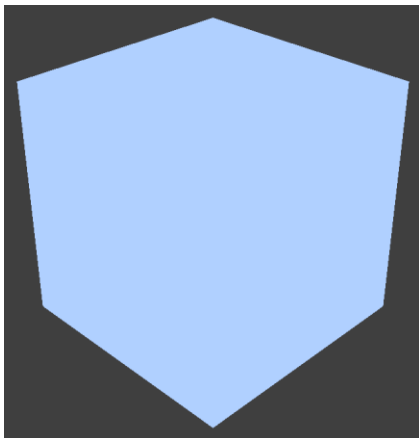
The Cube Single Color backdrop is a single color six-sided cube.



Size – specify the size of the cube in world units.

Color – specify the color of the cube.

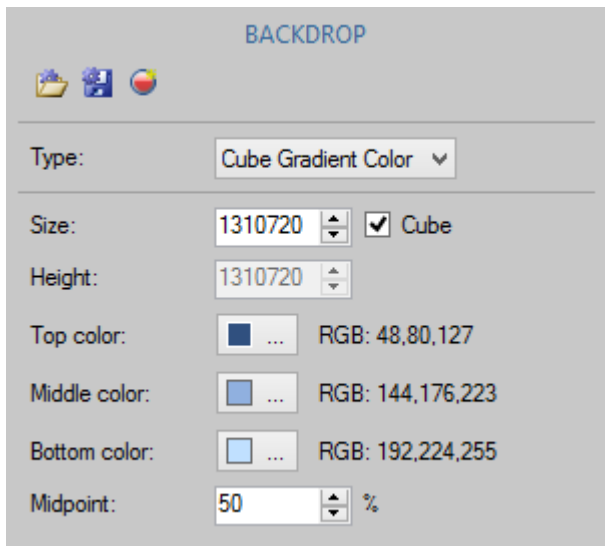
The pop-up Color Dialog also includes 16 common sky color presets.



Scene: Backdrop: Cube Gradient

Professional Edition Only

The Cube Gradient Color backdrop is a three color six-sided cube with the color gradient along the Y axis.



Size – specify the size or width/length size of the cube in world units.

Cube – maintains a cubic height-to-width/length size shape when checked.

Height – specify the height of the cube when the Cube checkbox is not checked.

Top Color – specify the top color of the cube.

The pop-up Color Dialog also includes 16 common sky color presets.

Middle Color – specify the middle color of the cube.

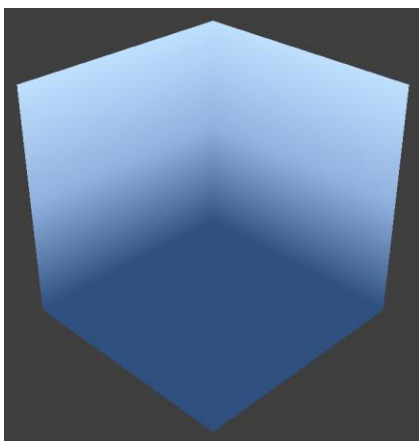
The pop-up Color Dialog also includes 16 common sky color presets.

Bottom Color – specify the bottom color of the cube.

The pop-up Color Dialog also includes 16 common sky color presets.

Midpoint – specify the midpoint percent where the middle color is located along the cube height.

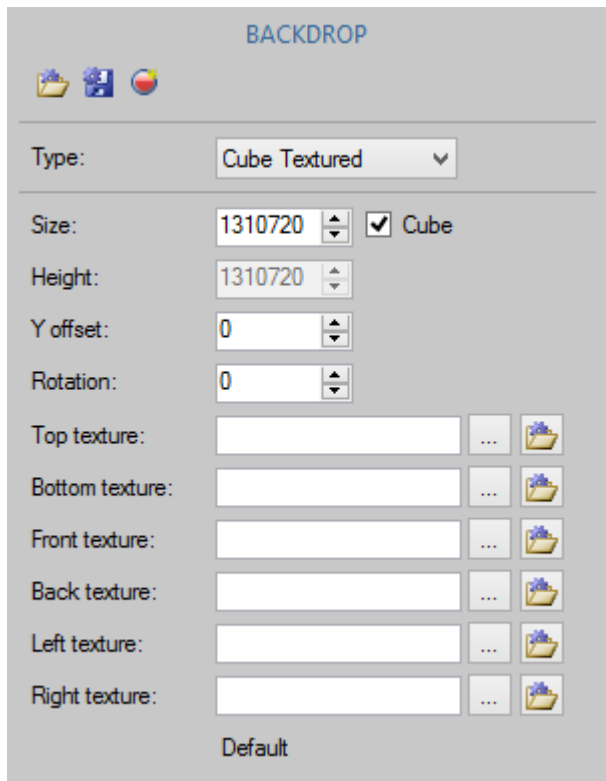
A midpoint of 0 is the bottom of the cube, a midpoint of 100 is the top of the cube.



Scene: Backdrop: Cube Textured

Professional Edition Only

The Cube Textured backdrop is a six texture six-sided cube.



Size – specify the size or width/length size of the cube in world units.

Cube – maintains a cubic height-to-width/length size shape when checked.

Height – specify the height of the cube when the Cube checkbox is not checked.

Y offset – specify the world Y-axis offset for the center of the cube.

Rotation – specify the world Y-axis rotation around the center of the cube.

Textures

The textured cube backdrop supports square-aspect or 2:1 width:height textures only. See the chapter on Texture Support for a list of supported texture formats and sizes.



browse for a texture file.



load or re-load the specified texture file.

Top texture – specify the texture file to display on the cube top surface.

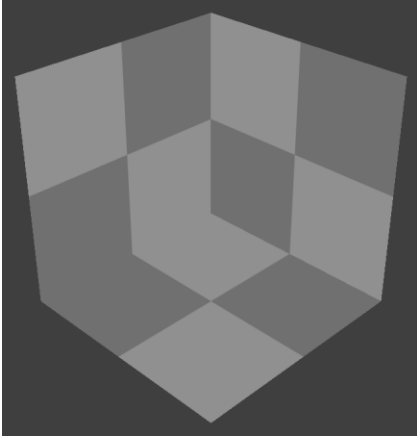
Bottom texture – specify the texture file to display on the cube bottom surface.

Front texture – specify the texture file to display on the cube front surface.

Back texture – specify the texture file to display on the cube back surface.

Left texture – specify the texture file to display on the cube left surface.

Right texture – specify the texture file to display on the cube right surface.



Creating Cube Textures

Professional Edition Only

Cube textures are a set of six square-aspect images that are applied to each side of the backdrop cube using planar UV mapping coordinates.

The mapping coordinates are configured for 1:1, 1:2 or 2:1 aspect support.

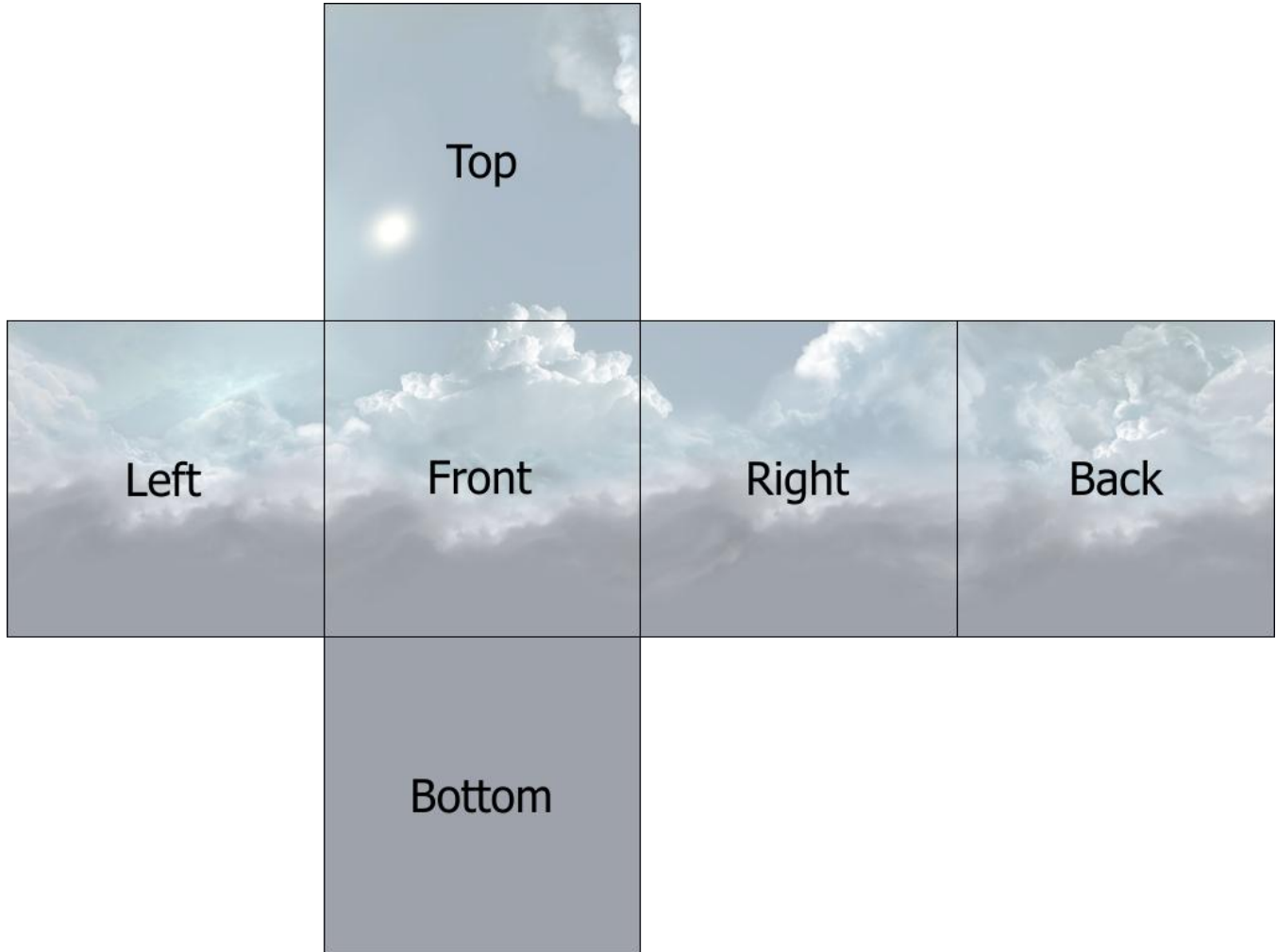
The 1:2 aspect requires setting the Height property to 2x the Size property.

The 2:1 aspect requires setting the Height property to ½ of the Size property.

The textures must be seamless on all edges.

The six texture images are laid out as a cube that has been folded out and flattened.

The textures should not include any alpha channel information.

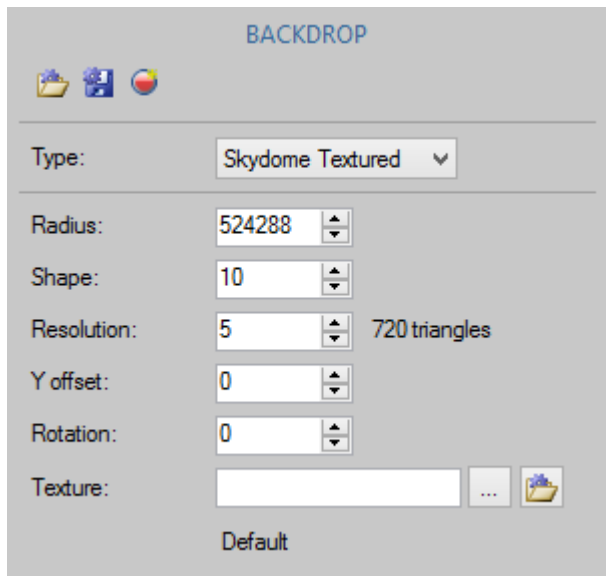


Note: the black lines are to visually depict the texture borders and would not be included in the actual textures.

Scene: Backdrop: Skydome

Professional Edition Only

The Skydome backdrop is a textured variable shape hemisphere.



Radius – specify the radius of the dome in world units.

Shape – specify the shape of the dome. The shape range determines the flatness of the hemisphere.

Resolution – specify the dome mesh resolution.

Y offset – specify the world Y-axis offset for the base-center of the dome.

Rotation – specify the world Y-axis rotation around the center of the dome.

Texture – specify the texture file to display on the dome surface.

The skydome backdrop supports 4:1 ratio width:height textures only.

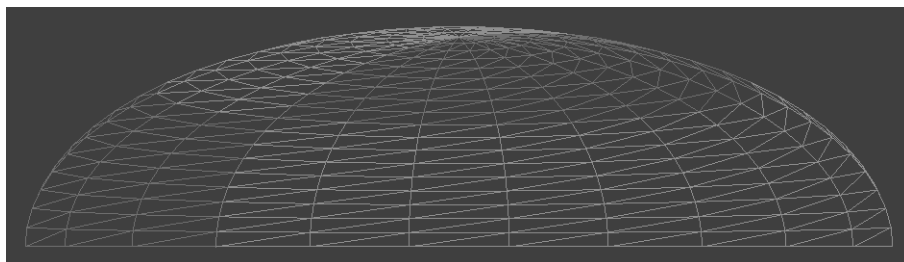
See the chapter on Texture Support for a list of supported texture formats and sizes.



browse for a texture file.



load or re-load the specified texture file.



Creating Skydome Textures

Professional Edition Only

Skydome textures are panorama images that are applied using spherical UV mapping coordinates. The mapping coordinates are configured for 4:1 aspect support. 2:1 and 1:1 aspect textures will be stretch-distorted along the texture U (width).

The texture must be seamless on all edges.

The texture top 50 to 100 pixels should be blurred to a single color to prevent visible UV coordinate compression at the dome top.

The texture should not include any alpha channel information.

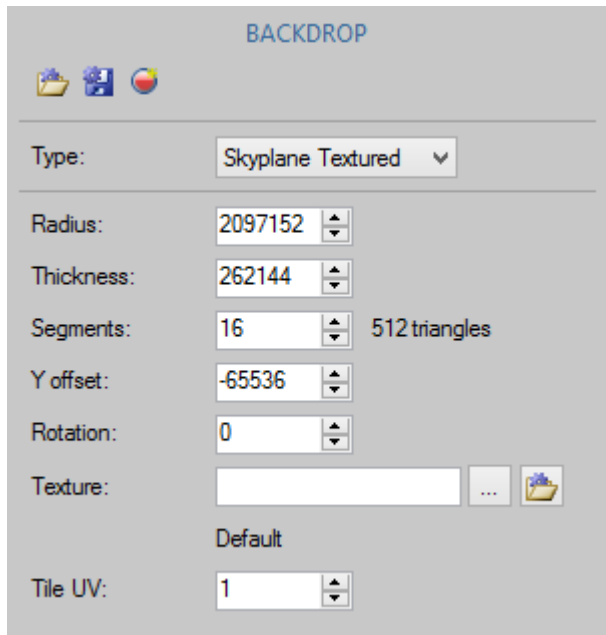


Note: the black lines are to visually depict the texture border and would not be included in the actual texture.

Scene: Backdrop: Skyplane

Professional Edition Only

The Skyplane backdrop is a textured variable shape draped plane. The plane is effectively the sheared top section of an imaginary bounding sphere.



Radius – specify the equivalent radius of the imaginary bounding sphere in world units.

Thickness – specify the thickness of the plane slice from the top of the imaginary bounding sphere.

Segments – specify the plane width and length segments resolution.

Y offset – specify the world Y-axis offset for the base-center of the plane.

Rotation – specify the world Y-axis rotation around the center of the plane.

Texture – specify the texture file to display on the plane surface.

The skyplane backdrop supports square-aspect textures only.

See the chapter on Texture Support for a list of supported texture formats and sizes.

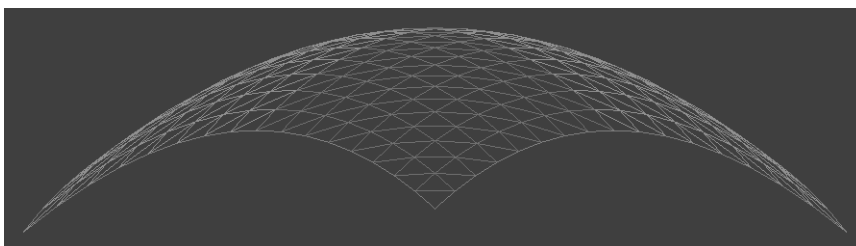


browse for a texture file.



load or re-load the specified texture file.

Tile XY – specify the texture tiling along the width and length of the plane.



Creating Skyplane Textures

Professional Edition Only

Skyplane textures are square aspect images, optionally seamlessly tileable, that are applied using planar UV mapping coordinates.

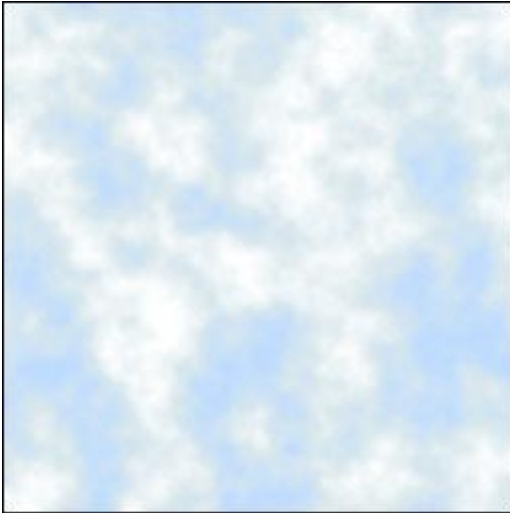
The mapping coordinates are configured for 1:1 aspect (square) texture support.

The texture must be seamlessly tileable on all edges if the Tile XY property is set to any value other than 1.

The texture should not include any alpha channel information.

The texture can be either planar or spherical content design.

Planar texture:



Note: the black lines are to visually depict the texture border and would not be included in the actual texture.

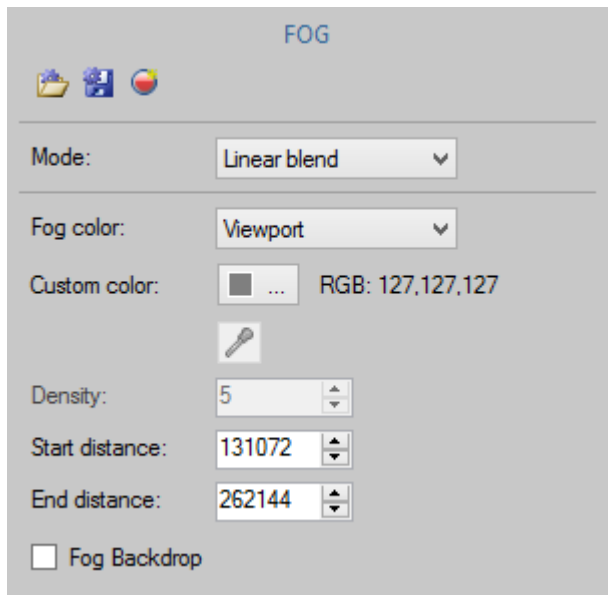
Spherical texture:




Scene: Fog


Scene fog adds a distance fogging effect to the 3D editor scene, which provides a pleasing real-world effect of haze or fog.

 Fog is toggled on and off with the toolbar Scene drop-down Fog menu item.



 Load the original fog settings from the application settings file.

 Save the current fog settings to the application settings file.

 Reset the fog to the default settings.

Mode – specifies the fog blending factor mode.

Linear: performs a linear blend from the Start distance to the End distance.

Exponential: performs an exponential distance blend of Density fog thickness.

Exponential 2: performs an exponential-squared distance blend of Density fog thickness.

Fog Color – specifies the color of the fog. The fog color is typically set to the color of the scene background.

Viewport: the fog is the color of the viewport background.

Custom: the fog is the specified custom color. See the Custom Color property.

Custom Color – specifies the custom fog color. This is relevant for Fog Color Custom only.

Custom Color Picker – future feature.

Density – specifies the fog density. This is relevant for Exponential and Exponential 2 modes only.

Start distance – specifies the fog start distance in world units. This is relevant for Linear mode only.

Lower values pull the fog start closer to the camera.

The Start distance value should always be less than the End distance value.

End distance – specifies the fog end distance in world units. This is relevant for Linear mode only.

Any objects in the scene that are End distance from the camera will be solid fog color.

Lower values pull the fog end closer to the camera.

The End distance value should always be greater than the Start distance value.

Fog Backdrop – specifies whether the scene Backdrop is affected by Fog.

When this property is false, the scene backdrop will not be included in the scene fog. The chosen Fog Color should match with the backdrop color to provide proper visual blending. Backdrop textures may include a solid color band along their bottom edge in order to facilitate better scene blending with the terrain.

When this property is true, the scene backdrop will be included in the scene fog. The backdrop will be fogged according to the fog properties, which may cause the backdrop to fade or to be hidden by the fog.

Fog Mode Equations

The fog mode and its fog equation determine the fog *factor* at specific distances from the scene camera.

In simple terms, the fog factor is each rendered pixel's original color to fog color ratio. Typically, pixels on scene objects that are close to the camera are rendered at their original color, while pixels on scene objects that are far from the camera are rendered with the fog color.

In technical terms, fogging is accomplished by blending the fog color C_{fog} with the scene fragments' color C_{frag} using a fog blending factor f using the formula $C = f * C_{frag} + (1 - f) * C_{fog}$

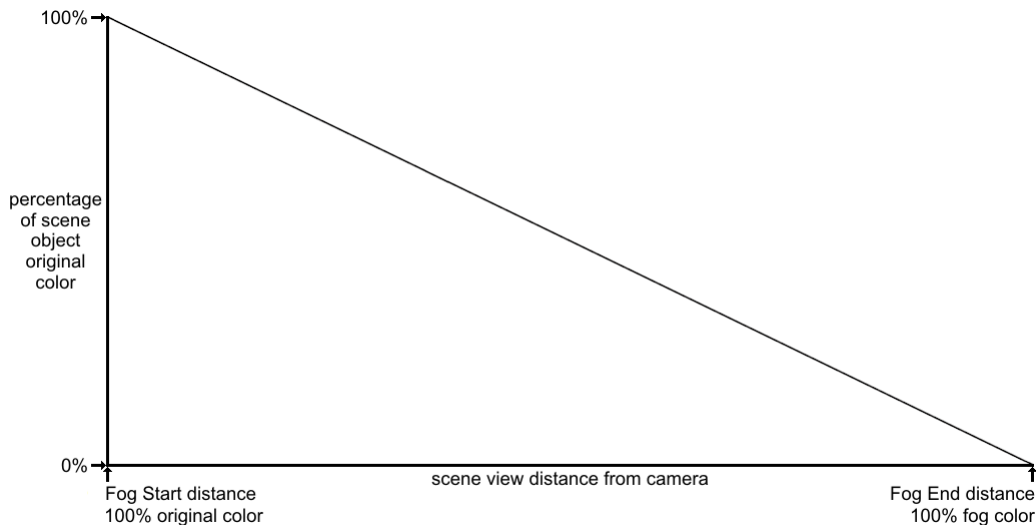
Linear Fog Mode

Linear fog mode uses the Fog Start Distance and Fog End Distance properties to determine the two distances from the camera where the fog begins and ends. Linear fog mode will color with 100% solid fog color any scene object pixels that are at or beyond the fog end distance value. The Fog Density property value is ignored.

The blending factor for linear fog mode is calculated using the equation $f = (end - z) / (end - start)$, where:

- f = fog blending factor
- $start$ = fog start distance value
- end = fog end distance value
- z = the distance between the camera and the fragment center

When plotted as a graph, linear fog mode appears as follows.



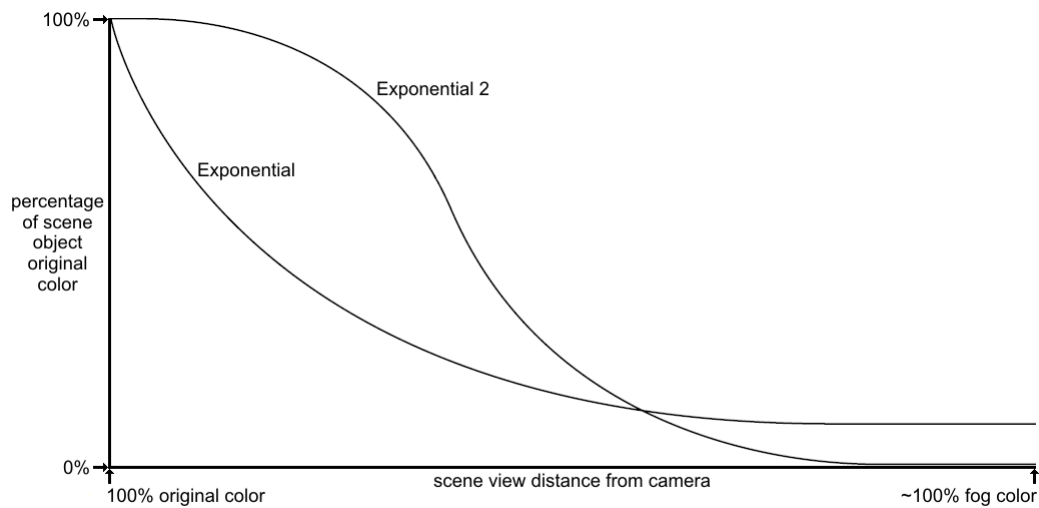
Exponential Fog Modes

Exponential fog modes use the Fog Density property to determine the fog density over distance from the camera. Exponential fog modes do not color the most distant pixels at 100% solid fog color. The Fog Start Distance and Fog End Distance property values are ignored.

The blending factors for the exponential fog modes are calculated using the equations $f = \text{exponent}(-d * z)$, and $f = \text{exponent}(-d * z)^2$ where:


- f = fog blending factor
- d = fog density value
- z = the distance between the camera and the fragment center

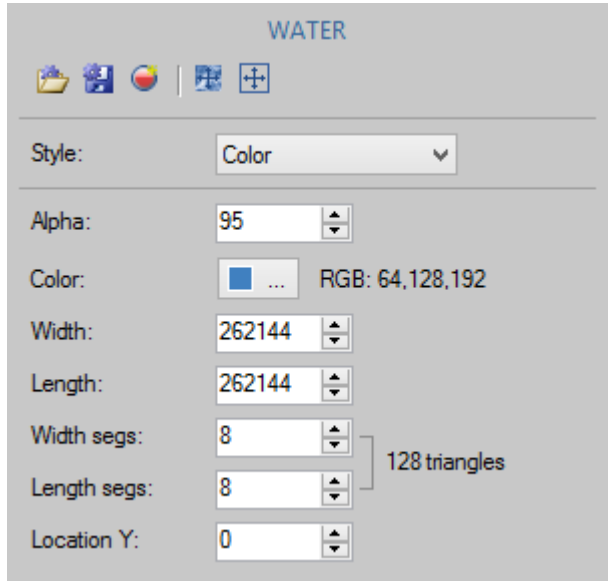
When plotted as a graph, the exponential fog modes appear as follows when Fog Density is at 50% of its value range.




Scene: Water


Scene water is a flat plane mesh that is used to simulate sea-level and is typically located at the center of the world Y axis, which in world units is a Y of 0. The center of the world Y axis is also the heightmap altitude value 50.0.


 Water is toggled on and off with the toolbar Scene drop-down Water menu item.




 Load the original water settings from the application settings file.

 Save the current water settings to the application settings file.

 Reset the water to the default settings.

 Set the water spacing*size to the current terrain dimensions.

 Set the water spacing*size to the world extents.

Style – specifies the water rendering style.

Color: a single specified color.

Texture: a specified texture (*Professional Edition Only*).

Alpha – specifies the water plane mesh transparency alpha color. 0 is transparent, 255 is opaque.

Color – specifies the water plane mesh color. This will tint the texture color for a texture style water.

Width – specifies the water plane mesh width along the world X axis in world units.

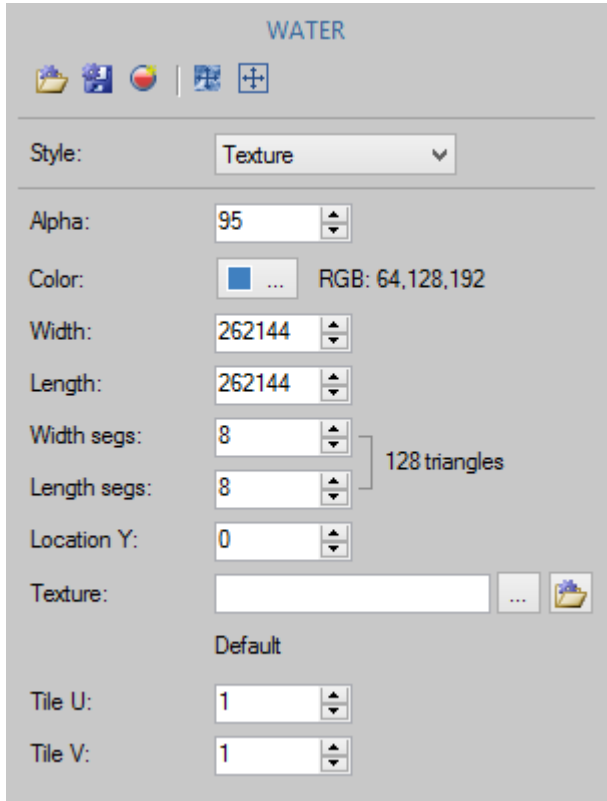
Length – specifies the water plane mesh length along the world Z axis in world units.

Width segments – specifies the number of water plane mesh quad segments along the plane width.

Length segments – specifies the number of water plane mesh quad segments along the plane length.

Faces – displays the total number of water plane mesh triangles, the plane (width × length) × 2.

Location Y – specify the water plane mesh location along the y axis in world units.





Texture – specify the texture file to display on the water plane mesh.

The water supports square-aspect textures only.

32-bit textures with alpha are supported.

See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.

Tile X – specify the number of times to tile the texture along the texture x axis.

Tile Y – specify the number of times to tile the texture along the texture y axis.

Creating Water Textures

Professional Edition Only

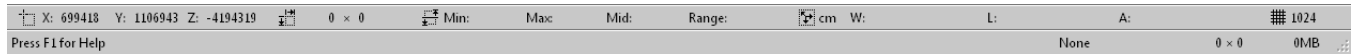
Water textures are a square or rectangular aspect image that is applied using planar UV mapping coordinates. The mapping coordinates are configured for any aspect support. The Tile X and Tile Y properties should be set to match the texture aspect.

The texture must be seamlessly tileable on all edges if the Tile X / Tile Y properties are set to any value other than 1.


The texture may support alpha channel information for translucency.

The Statusbars


Located at the bottom of the application window are the Statusbars.
The statusbars display a variety of relevant information for the current scene and terrain.





Information Statusbar

 **X Y Z** – The current mouse pointer world position X,Y,Z.

 **0 x 0** – The current selection area, width x length.

 **Min Max Mid Range** – The current terrain heightmap altitude values:
Minimum, Maximum, Middle, and Range.

 **W L A** – The current terrain area: Width, Length and total Area in the current Units value.

 **1024** – The current home grid spacing.

Status Statusbar

Press F1 for help – The current application information and status line.

None – The currently opened file format.

0 x 0 – The current terrain heightmap dimensions, width x length.

0MB – The current terrain heightmap memory requirement.

Initial Application Settings

After installing the software onto a computer, the initial application settings should be set to the desired defaults. Choose the *Settings* item on the *Tools* menu to display the Settings dialog. Only the most common settings are covered here.

General tab:

- Choose whether to create a backup file on every save.
- Choose whether to display the Welcome dialog whenever the application is started.
- Choose whether to disable the Undo system, and specify the default Undo temporary file folder.

Dimensions tab:

- Choose the desired terrain heightmap range to show in the New dialog etc.
- Choose which of the dimensions sizes sets to display.

Formats tab:

- Select the default heightmap, image, mask and weightmap file formats.

Preferences tab:

- Choose whether to enable or disable the Center altitude, Zoom extents, Design and Water auto-size options.

Ruler and Units tab:

- Specify the default heightmap sample point (vertex) spacing according to the target rendering engine. Unreal Engine 3 has a default terrain DrawScale3D of 256:256:256, although the XYZ Spacing should normally be at a 4:4:1 ratio such as 256:256:64 in order to allow for finer z-axis control and detail.
- Specify the world-units to real-world-units ratio. Most Unreal Engine games use a default measurement system of 1 unreal unit = 2 centimeters.

System tab:

- Choose the Preview resolution based on the computer performance.

The other Settings dialog tabs can be adjusted as required, however they contain more advanced settings. See the Settings chapter of this document for additional information on all of the settings.

Colorsets

Standard computer monitors are capable of displaying 24-bit color, which is comprised of 8-bits of red, 8-bits of green, and 8-bits of blue. When summed together as a grayscale, standard monitors can display 8-bits or 256 levels of gray starting from black and continuing up to white.

The heightmaps created and edited by TerreSculptor use a floating-point altitude range from 0.0 to 100.0, which literally has millions of values. For terrain vertex color rendering purposes the floating point altitude values are converted to a 16-bit value from 0 to 65535. This 16-bit value cannot be displayed as a 1:1 color or grayscale match on a standard 8-bit grayscale capable monitor.

Colorsets provide a method for displaying 48-bit simulated color on standard 24-bit color computer displays. This is equivalent to displaying 16-bits per pixel on 8-bits per pixel displays. Colorsets are created by deriving linear-interpolated gradient ranges of color starting at color value 0 and ending at color value 65535.

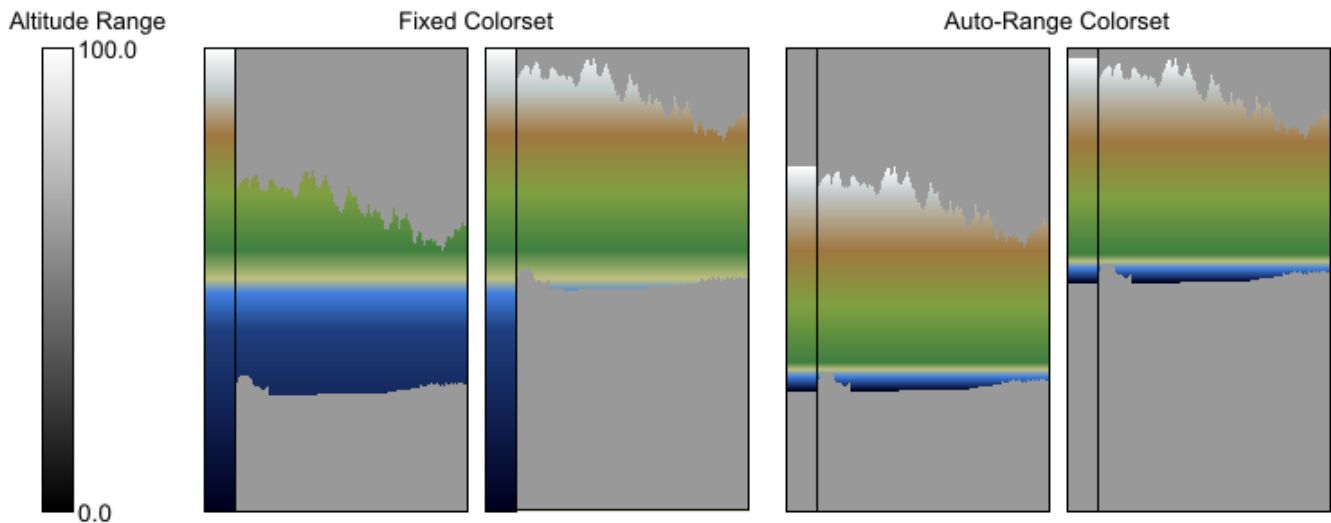
A wide variety of Colorsets are included in TerreSculptor. Many of the Colorsets are designed to simulate real-world terrain coloring such as sandy deserts and green lush forests.

Auto-Range Colorsets

The Auto-Range Colorsets differ from standard fixed Colorsets in that they are always rendered following the current altitude range of the heightmap. If the heightmap altitude range is changed, the auto-range colorset will automatically map itself correctly to the new heightmap range.

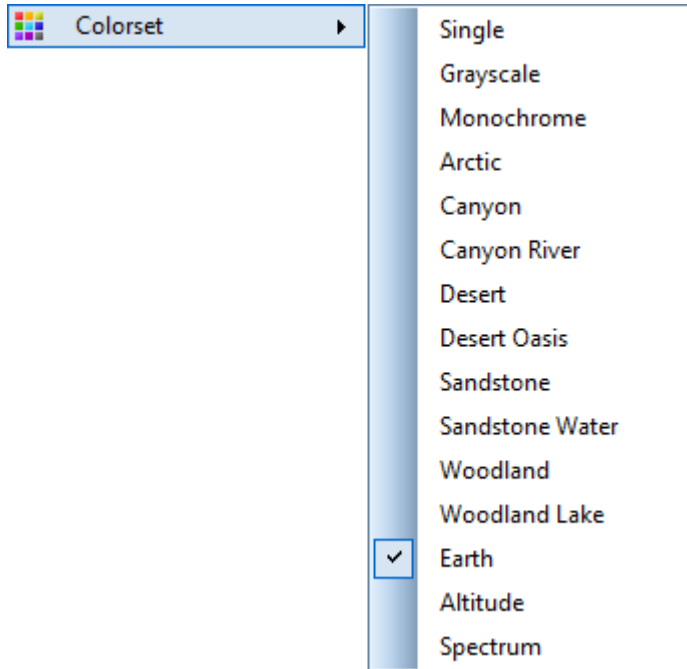
The Auto-Range Colorsets provide a closer simulation of real-world terrain coloring, while the fixed Colorsets provide a better visual representation of the heightmap range's position in the overall available 16-bit range.

In this diagram of a heightmap front view, notice that for the fixed Colorset, the heightmap coloring follows the Colorset colors. While for the Auto-Range Colorset, the Colorset colors follow the heightmap.



Colorset fly-out menu

The Colorset menu item opens a second fly-out menu that contains the available render color sets. Most of the color sets are designed to simulate various earth or planetary geological region colorings.



Single – A single color as defined in the Options. Typically used when painting the terrain.

Grayscale – Grayscale from black to white. This colorset is unaffected by the Auto-Range Colorset setting.

Monochrome – Grayscale from black to white. Similar to lunar or moon coloring.

Arctic – Blue arctic winter.

Canyon – Red striped canyon.

Canyon River – Red striped canyon with water.

Desert – Sandy desert.

Desert Oasis – Sandy desert with water.

Sandstone – Red sandstone.

Sandstone Water – Red sandstone with water.

Woodland – Green trees.

Woodland Lake – Green trees with water.

Earth – Multi-colored from water to sandy beaches to white snowcaps.

Altitude – Multi-colored water to snow with evenly spaced ranges.

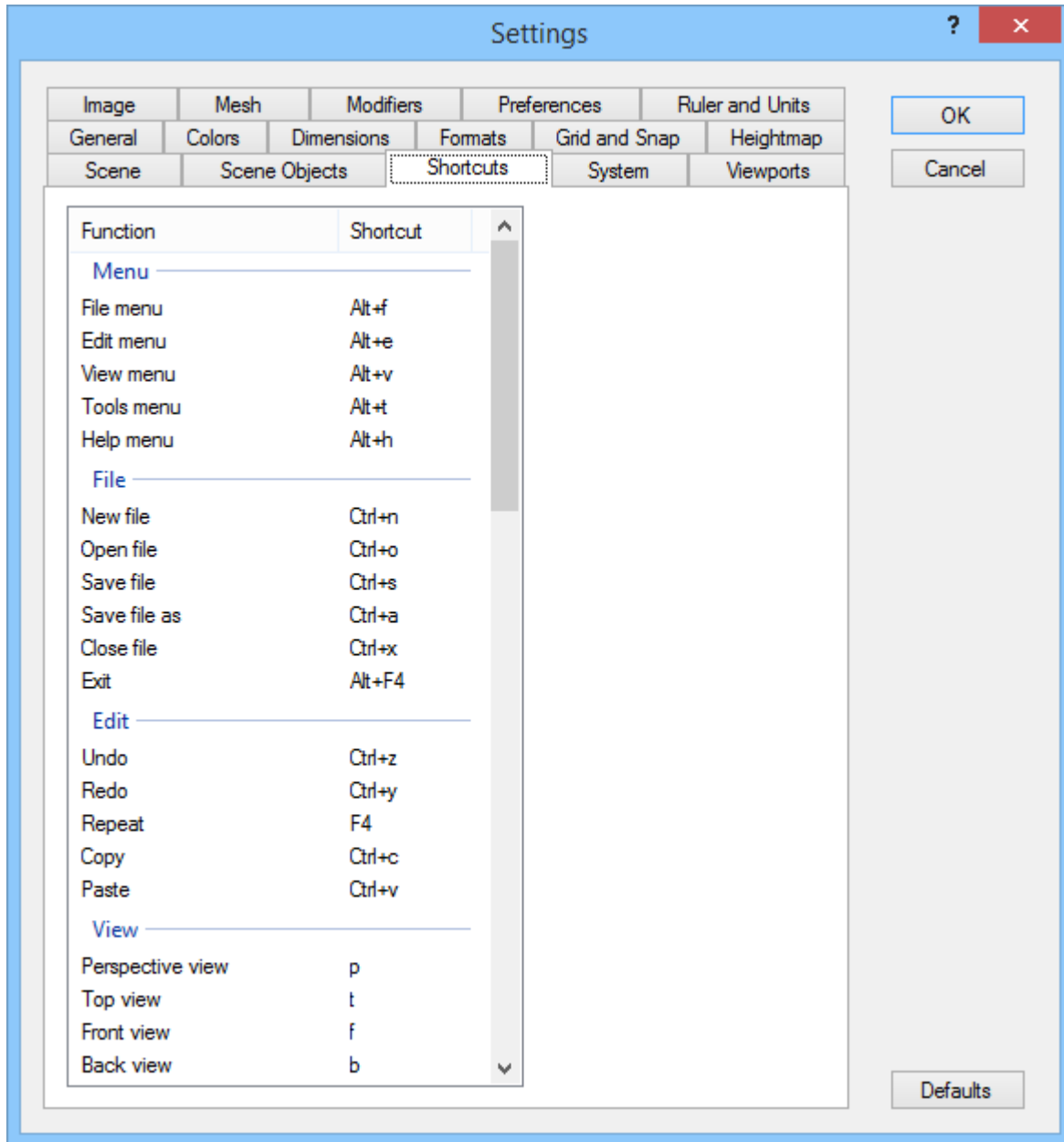
Spectrum – Multi-colored.

Shortcut Accelerator Keys

TerreSculptor provides a number of keyboard shortcut accelerator keys for single-key access to a number of the application features.

The shortcut accelerators are a combination of standard Windows shortcuts such as *Ctrl+n = New* and *Ctrl+o = Open*, plus a number of shortcuts that are similar in functionality to Autodesk 3DS Max such as *g = toggle grid* and *p = perspective view*, along with custom shortcuts specific to TerreSculptor.

See the Settings dialog Shortcuts tab for a complete list of shortcuts, or the Shortcuts Appendix in this document.



Terrain LOD Modes

The 3D Editor terrain mesh renderer supports multiple Level of Detail (LOD) modes to enhance render performance and system CPU and GPU memory requirements.

The LOD modes can lower render cost and memory requirements by reducing the number of terrain mesh sections and triangles that are rendered in the viewport.

TerreSculptor's terrain rendering system splits the heightmap into square chunks called sections. These sections are used for enhancing performance through frustum culling. Additional performance enhancing is performed by LOD'ing the heightmap data used for the sections.

The Aggressive and Normal LOD modes effectively specify a fast low resolution and a slower maximum resolution terrain mesh.

Aggressive LOD

This is the default terrain rendering LOD mode.

This mode is well suited for general terrain visualization, and to conserve on GPU memory.

Aggressive LOD reduces the heightmap resolution to the *Aggressive LOD resolution (ALODR)* value specified in the application Settings. Heightmap resolutions below the ALODR value will be rendered normally; heightmap resolutions above the ALODR value will be reduced to the ALODR value prior to rendering. The ALODR resolution reduction respects the original heightmap aspect ratio.

For example, with an ALODR value of 1024 and a heightmap of 2048 × 2048:

- The rendered heightmap resolution will be 1024 × 1024 with 2× vertex spacing to maintain the same area.
- The GPU memory requirements for the LOD mesh data will be 48.26MB versus the non-LOD of 193.08MB.

Normal LOD

The Normal LOD mode renders the full heightmap terrain mesh with no level of detail reduction, up to the maximum resolution specified in the settings.

This mode should only be used when necessary and only if the system GPU has sufficient video memory.

For large heightmaps the amount of required GPU memory can be high. A 4096 × 4096 terrain will require 772.42 MB of video memory to render the 33 million triangles. This is approximately three-quarters of a GB. Additional GPU memory will be required on top of the terrain for the other scene objects. For a Normal LOD of 4096, a GPU with 2GB of memory would be a minimum system requirement.

Terrain LOD Settings

The Terrain Settings for the LOD modes can be found on the Settings dialog, Scene Objects tab, Terrain group.

Terrain

Use auto-range colorsets

Colorset:

LOD mode:

Aggressive LOD resolution:

Normal LOD resolution:

- LOD mode: The default terrain LOD mode.
The current LOD mode can be changed at any time on the toolbar.
- Aggressive LOD resolution: The maximum dimensions of the terrain heightmap in aggressive LOD mode.
- Normal LOD resolution: The maximum dimensions of the terrain heightmap in normal LOD mode.

Undoing Changes

You can easily undo changes that you have made to your scene or terrain heightmap. TerreSculptor manages individual undo buffers for the Base Heightmap modification tools, and for the various textbox and numeric input controls on the dialogs and Function tabs.

Setting the Undo Settings

The Settings dialog contains Undo preferences that can be set by the user. These Undo preferences relate to the Undo menu and toolbar items only, which are for the Base Heightmap modification tools' Undo system.

To set the Undo preferences:

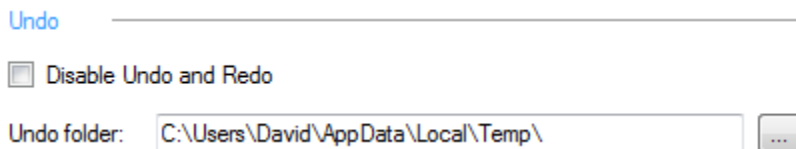
1. Choose the Settings item on the Tools menu.
2. Click on the General tab.
3. Change the Undo options as preferred.

You can:

- Disable the Undo.
- Specify the Undo folder.

The undo folder drive should have at least 1GB or more of free space.

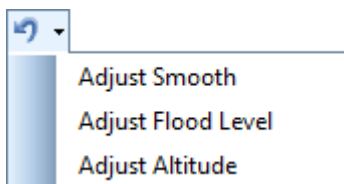
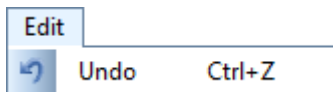
A fast hard drive or SSD will make the Undo system perform quicker.



Undoing changes to the Base Heightmap

Use the Undo toolbar buttons or Undo commands in the Edit menu to reverse the effect of any of the Base Heightmap modification tools. The Base Heightmap modification tools undo system has 10 levels of undo.

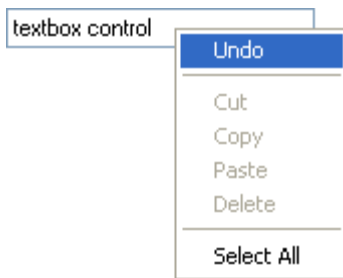
The Undo toolbar buttons include a drop-down menu that displays the current modification tools that are on the Undo buffer stack. These are for reference only, choosing the Undo will always undo the top-most item on the undo stack list.



Undoing changes to the Input Controls

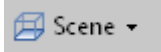
Most of the input controls found throughout the application include a single-level Undo. These input controls include text boxes and numeric entry controls.

Right-click the mouse on any supported input control to display its pop-up menu. Choose Undo on the pop-up menu to reverse the last change to the input control. Choosing Undo again will redo the change (undoing the undo).



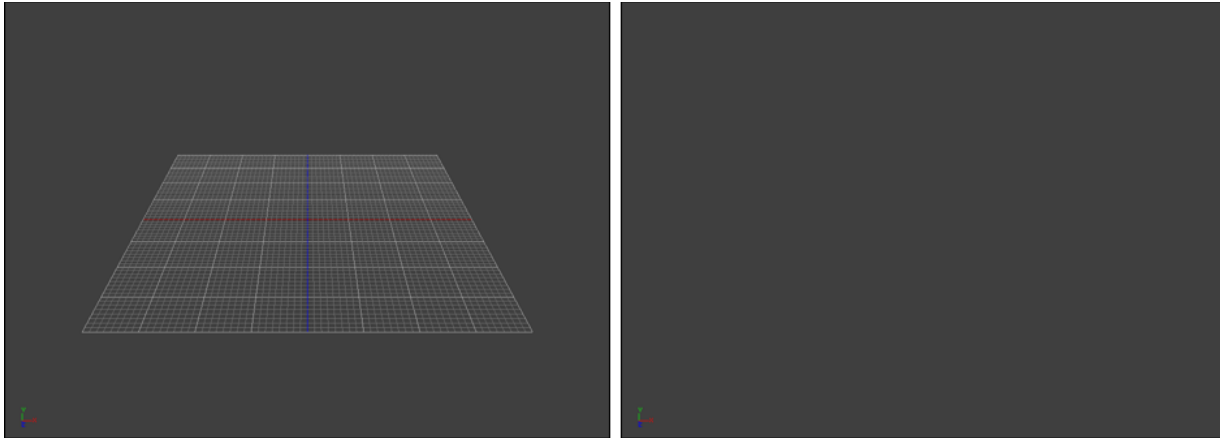
Scene Objects and Helpers

A variety of objects and helpers are available in the Editor Scene. These objects and helpers can be turned on and off, or hidden and shown, using the menu items on the toolbar Scene drop-down menu. The Scene Objects typically have editable properties, whereas the Scene Helpers are typically fixed in their function.



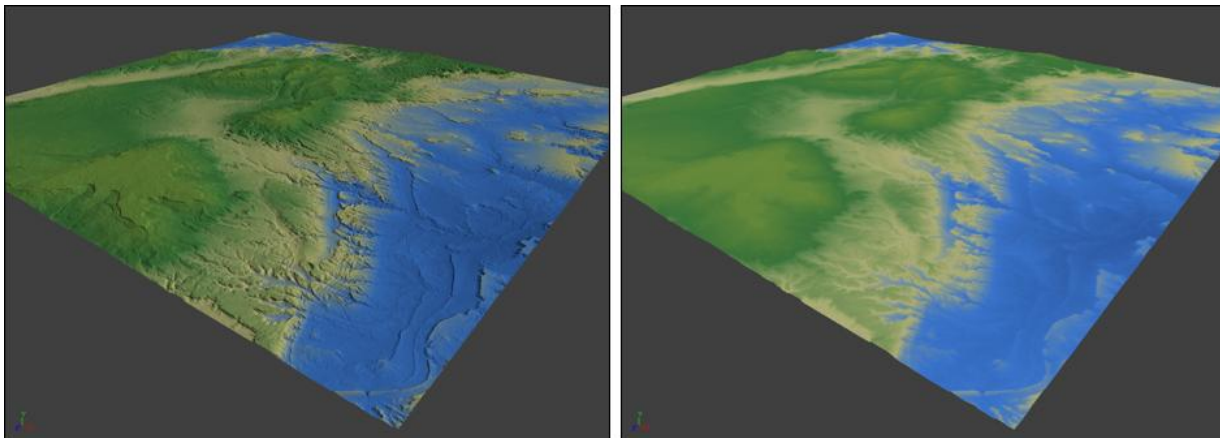
Home Grid

The scene Home Grid visible and hidden.
The Home Grid properties are available on the Function tabs.



Lighting

The scene Lighting on and off.
The Lights properties are available on the Function tabs.

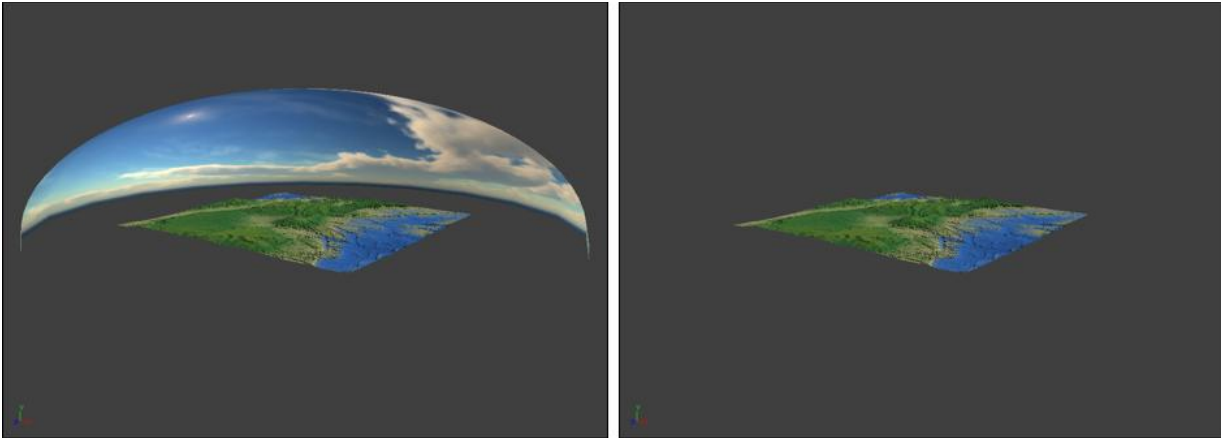


Backdrop

The scene Backdrop visible and hidden.

The Backdrop properties are available on the Function tabs.

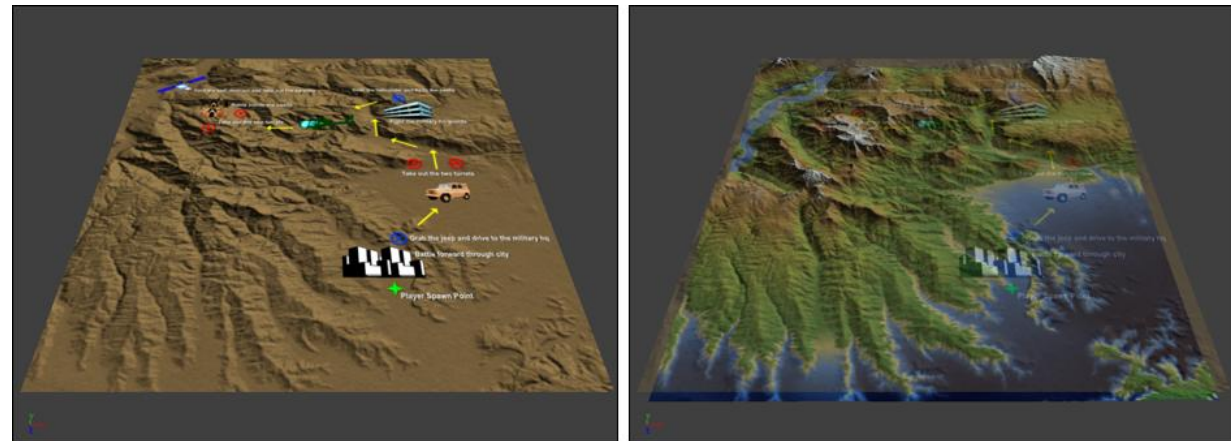
The skydome backdrop shown in the image below is available in the *Professional Edition* only.



Designer

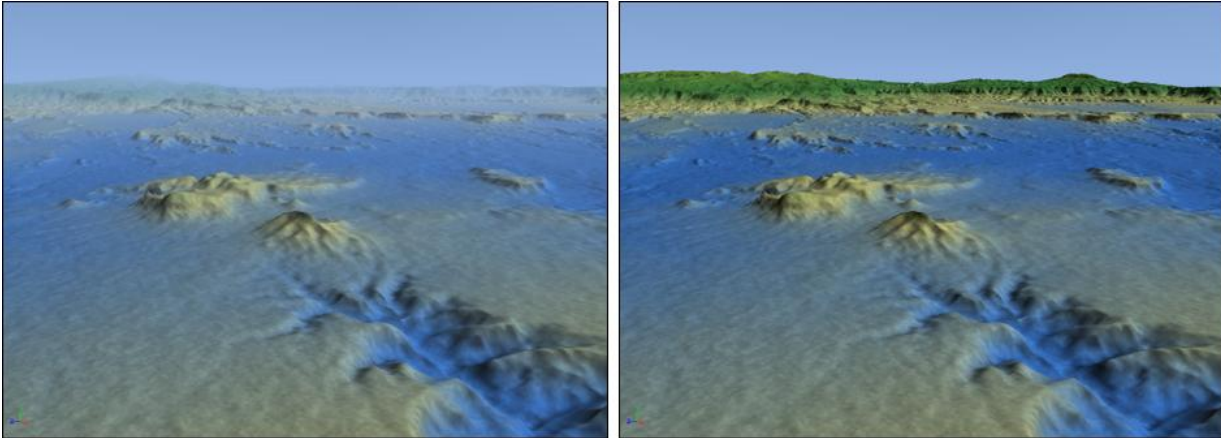
Professional Edition Only

The scene Designer with an example storyboard, and placed at 40% transparency over the terrain.



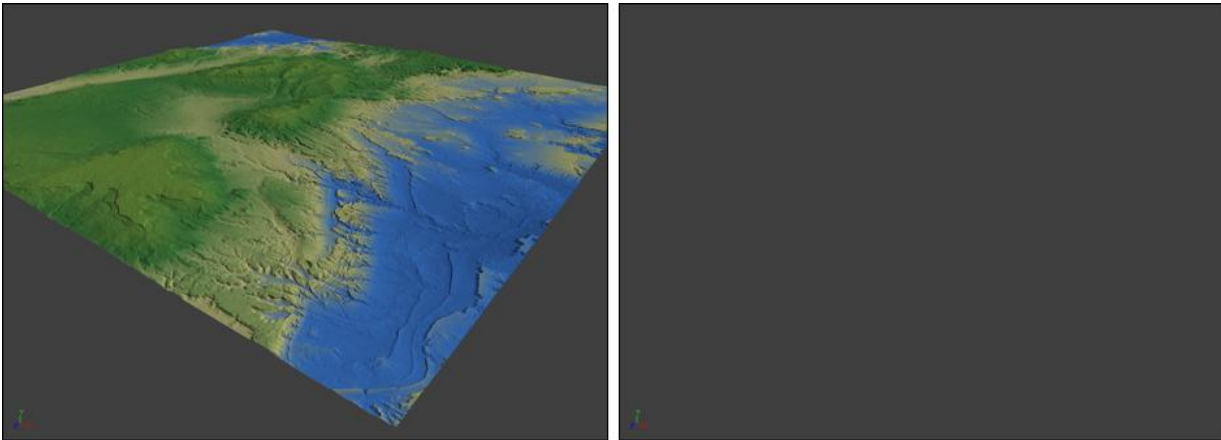
Fog

The scene Fog on and off.
The Fog properties are available on the Function tabs.



Terrain

The scene Terrain visible and hidden.
The Terrain properties are available on the Function tabs.

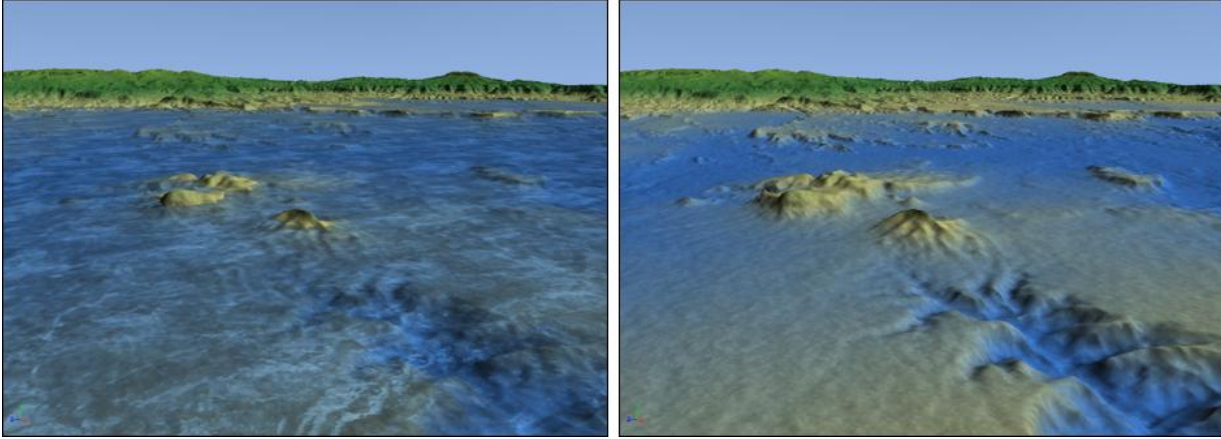


Water

The scene Water visible and hidden.

The Water properties are available on the Function tabs.

The textured water shown in the image below is available in the *Professional Edition* only.

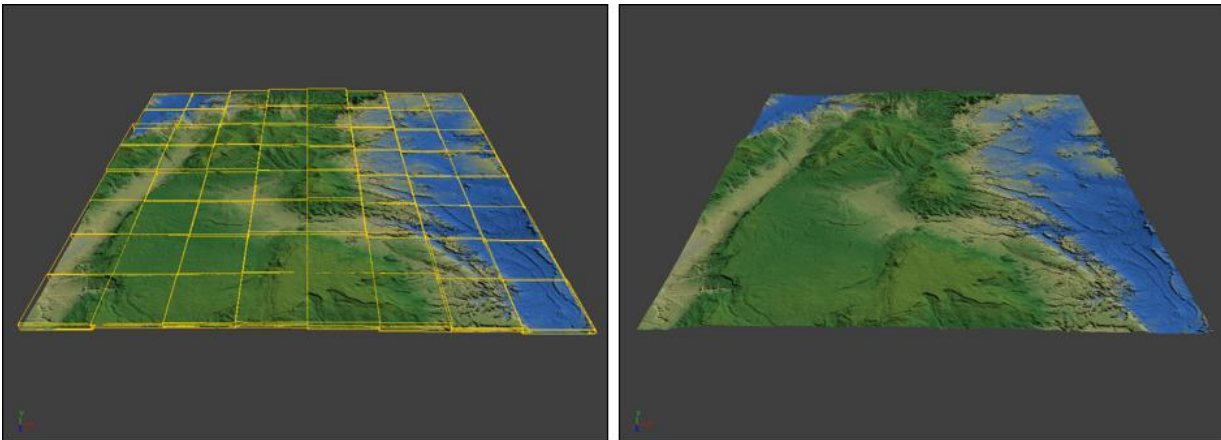


Object Bounds

The scene Object Bounds visible and hidden.

The Object Bounds do not have any editable properties.

The Object Bounds depict the cubic or spherical volume that totally encompasses a single specific scene object.



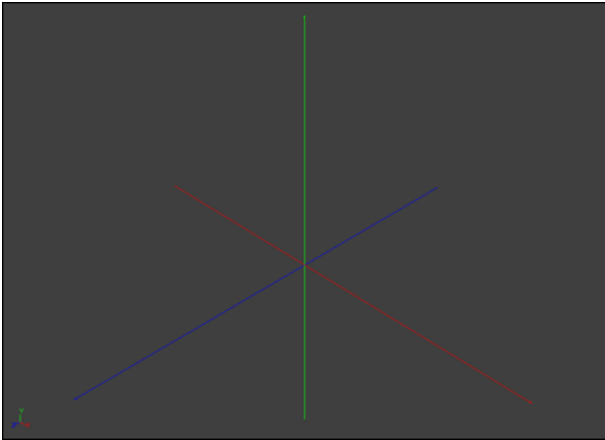
Origin Axes

The scene Origin Axes.

The Origin Axes do not have any editable properties.

The Origin Axes extend from the world origin along each axis plane.

The Origin Axes lines are colored for each of the XYZ planes and include an arrow depicting the axis positive direction.



Terrain Extents

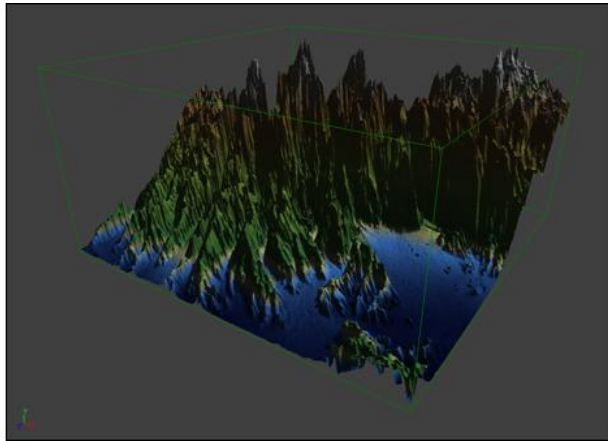
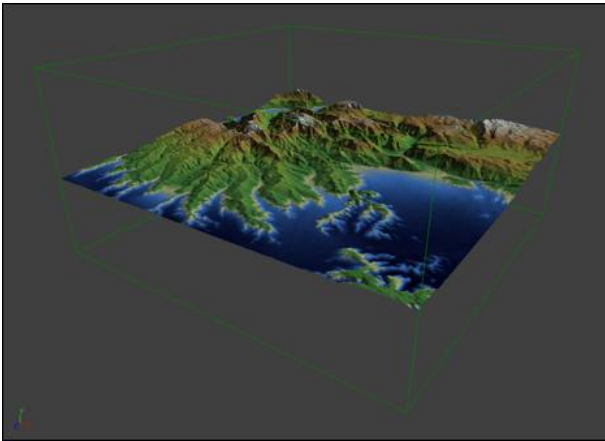
The scene Terrain Extents, with a terrain at default design and then normalized to fill the entire extents volume.

The Terrain Extents do not have any editable properties.

The Terrain Extents depict the maximum volume that the terrain can fill, which is the current width and length of the terrain and the maximum altitude height available for the terrain if it utilized the entire 0.0 to 100.0 value range.

The terrain width and length extents are calculated from the heightmap dimensions \times the Units XZ Spacing value.

The maximum terrain altitude height extents are calculated from the maximum 100.0 value range \times the Y Scaling factor value \times the Units Y Spacing value.



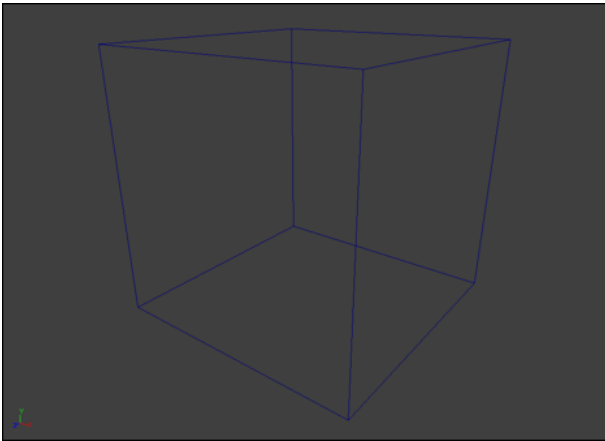
World Extents

The scene World Extents.

The World Extents has only one editable property, Segments, located in the Settings.

The World Extents depict the maximum world volume width, length, and height.

The Backdrop is the only object that should ever extend beyond the world extents.



Viewport Concepts

The viewport is a framed two dimensional window that is used to project the three dimensional scene from the position of the virtual camera. The viewport is a dynamic control with flexible tools for camera and object movement and selection during scene viewing and editing.

Multiple independent cameras are available, each with the ability to move to virtually any scene location, and to move using pan, truck, pedestal, and dolly. Using a few mouse movements and clicks, any level of scene detail can be reached.

Active Viewport

When TerreSculptor is started, the Editor is shown with its main viewport. This is the active viewport, where commands and other scene actions occur. Only one viewport can be in the active state at any time. When a dialog that contains a preview viewport is displayed, its viewport becomes the active viewport.

Orthographic Views

The orthographic views are two-dimensional flat views, each defined by two world coordinate axes with a fixed movement camera. Six different orthographic views are available. Each orthographic view is a combination pair of the three available axes producing the views for top, front, back, left, and right.

The orthographic views and their axes:

Top	XZ
Front	XY
Back	XY
Left	YZ
Right	YZ

To select an orthographic view:

1. Select the viewport orthographic view using the toolbar buttons:

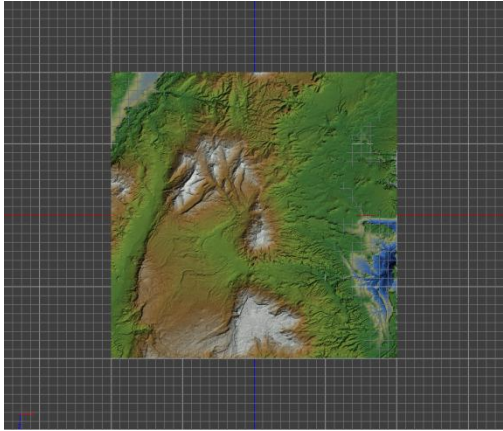
	Top
	Front
	Back
	Left
	Right

2. Select the viewport orthographic view using the keyboard shortcuts:

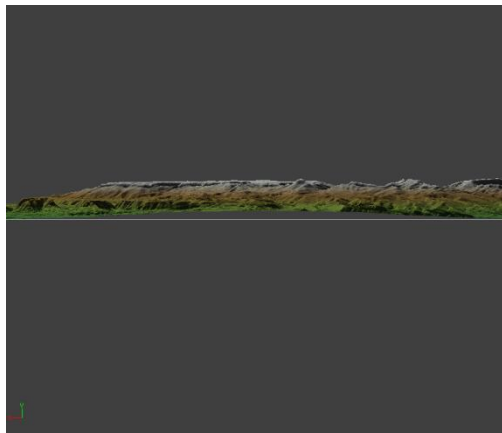
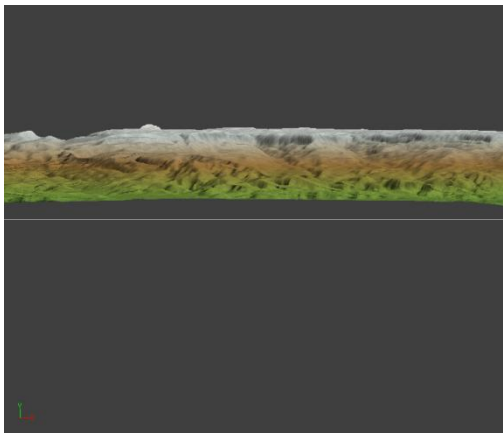
t	Top
f	Front
b	Back
l	Left
r	Right

What you see:

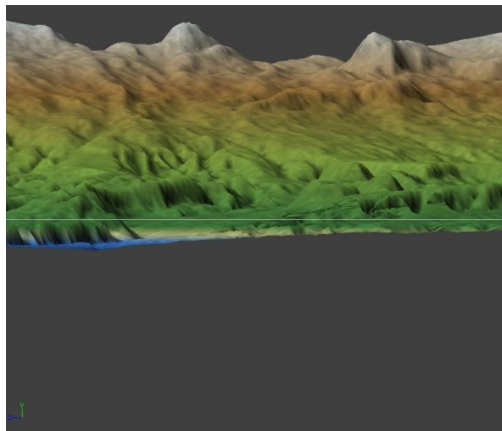
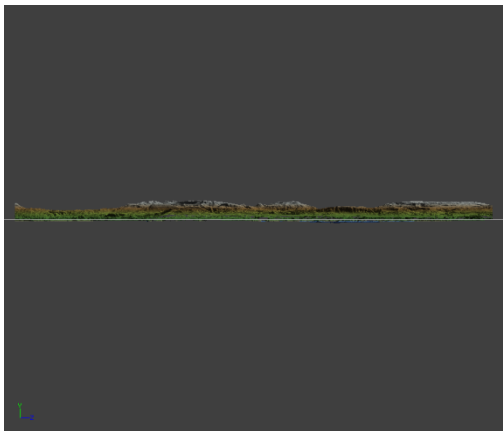
In top view, the camera is looking straight down the Y axis at the XZ plane.



In front and back view, the camera is looking down the Z axis, the X axis runs left and right, the Y axis is vertical.



In left and right view, the camera is looking down the X axis, the Z axis runs left and right, the Y axis is vertical.



Perspective View

Perspective view resembles how humans see the world around them. The scene appears three dimensional, and objects recede into the distance, creating a sense of depth. Perspective view is the typical view used when working in the TerreSculptor Editor.

The cameras in perspective view are capable of virtually any movement, position, and location within the world on the three axes.

The perspective camera's field of view (FOV) can be changed in the application settings, allowing for narrow-angle and wide-angle lens types.

To select perspective view:

1. Select the viewport perspective view using the toolbar button:

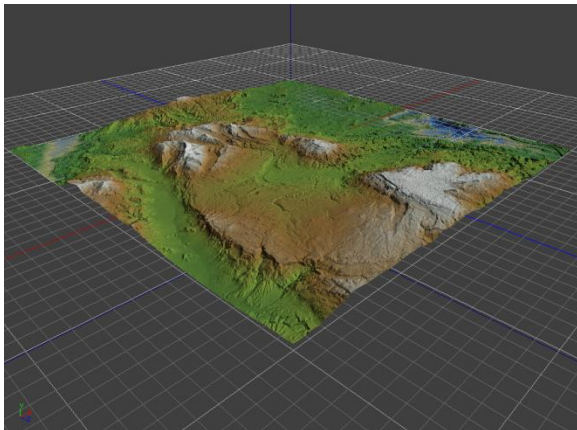
 Perspective

2. Select the viewport perspective view using the keyboard shortcut:

p Perspective

What you see:

In perspective view, the camera can move to virtually any world position and location.



Starting a New Project

To start a new project and create a new flat heightmap, choose the New Project item on the File menu or the New Project button on the main toolbar. Choosing New Project also resets many of the application settings to defaults.

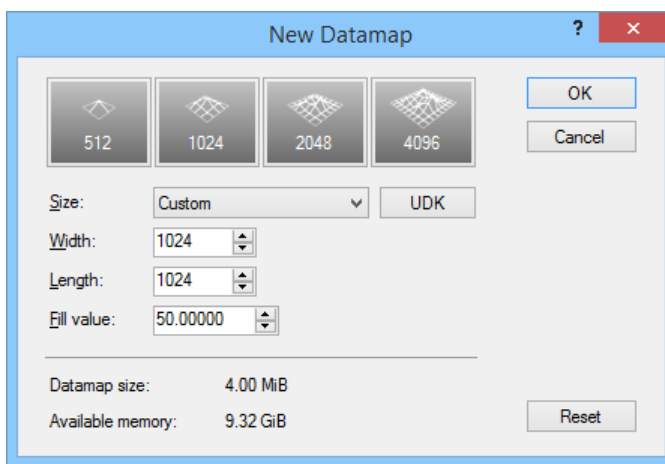
 New Project.

When the New Project item is selected, you will be prompted to save the current project data if it has changed, and then the New Datamap dialog will appear.

Choose the desired heightmap resolution from the preset buttons or drop-down combobox of common resolutions, or specify a custom size in the Width and Length numeric controls.

The Fill value numeric control allows you to specify the initial altitude level of the heightmap, which is typically the center altitude 50.0.

Once the new heightmap is created, the various tools can be used on it to create a custom terrain system.



OK Accept the settings and create a new heightmap.

Cancel Cancel the dialog.

Reset Reset the dialog to the default settings.

Preset buttons: Common square-aspect heightmap sizes.

Size: Choose a custom size or a common preset resolution.

UDK button: Choosing this button will display the UDK Landscape Sizes dialog. This button is available only when UDK Landscape is enabled in Settings, Dimensions.

Width: The heightmap custom width value.

Length: The heightmap custom length value.

Fill: The heightmap altitude level.

Datamap size: The amount of memory required to create the new heightmap.

Available memory: The total amount of available system memory.

Note: the available resolutions will depend on the application edition. The Professional Edition supports additional large resolutions.

Heightmap GeoTools





A variety of editing and modification *GeoTools* are available that modify the heightmap data in a wide number of ways. The GeoTools are found on the Adjust, Modify and Transform toolbar drop-down menus.

The Terrain Stack's Base Heightmap data can be modified directly and immediately by using the tools on the Adjust, Modify and Transform toolbar drop-down menus. Many of these same tools are also available on the Stack for any of the Heightmap objects during a standard terrain layout Stack build.



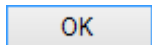
Dialog Context Help

All of the tools dialogs include instant context-sensitive help for every dialog control. To access the context help, click on the help button on the dialog window title bar, then move the help cursor over to the control you wish to get help for, and click again. A context help tooltip will temporarily pop up. Click anywhere on the screen to remove the help tooltip.

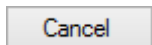
1. Click on this button:  or  or 
2. Move the help cursor over a control and click: 

Dialog Command Buttons

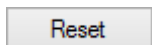
All of the tools dialogs include these command buttons.



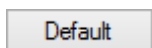
Accept the current settings and close the dialog.



Cancel and close the dialog.



Reset the dialog controls to their original settings when the dialog was initially opened. For immediate mode this results in the same action as the Default button. For world stack mode this resets the dialog to the settings that are currently on the stack.

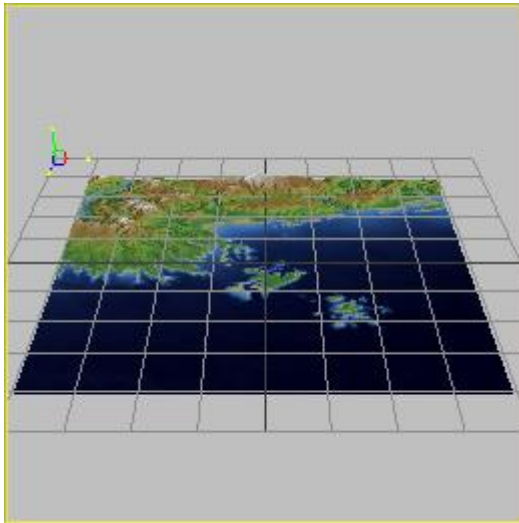


Set the dialog controls to their default settings.

Dialog Preview Window

Many of the heightmap tool dialogs include a real-time preview of their function. This real-time preview window displays a thumbnail version of the current object being adjusted. Depending on the tool dialog, the preview window supports one or more views and a number of display options available on the Preview Window Options Menu.

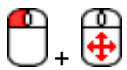
The preview window is often fully interactive with rendering settings and mouse control for panning or camera and light movement.



Preview Window Control

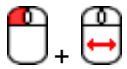
The preview window includes interactive viewing controls for each view mode.

2D 100% Zoom Virtual View, if available:

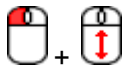


Pan the heightmap in the preview window in Virtual 100% 1:1 Pan View.

3D Perspective View, if available:



Camera orbit.



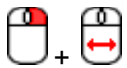
Camera pitch.



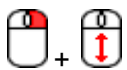
Camera dolly.



Cycle between the two camera dolly speeds (1x and 4x).



Directional Light orbit.



Directional Light pitch.

Preview Window Options Toolbar

Many of the heightmap GeoTool dialogs include a real-time preview of their function. This real-time preview includes a toolbar that can be used to set many of the preview options such as the view mode, render colorsets, and more. The specific toolbar buttons that are available may vary by the GeoTool chosen.



T Top view – Select the preview top 2D or 3D view.

F Front view – Select the preview front 2D or 3D view.

S Side view – Select the preview left side 2D or 3D view.

P Perspective view – Select the preview 3D perspective view.

100% 1:1 pan view – Select the preview top 2D 1:1 panning view.

Reset pan to origin – Reset the 1:1 pan view to the top-left edge of the preview.

Reset pan to center – Reset the 1:1 pan view to the center of the preview.

Show axis icon – Toggle the visibility of the XYZ tripod axis icon.

Show grid – Toggle the visibility of the grid.

Show water plane – Toggle the visibility of the water plane. The water plane is always at a world Y of 0.

Auto-range Colorset – Render the preview using the auto-range version of the specified colorset. See the chapter on Colorsets.

Colorset – Render the preview using the specified colorset. See the chapter on Colorsets.

Reset camera – Reset the orbit camera to its default position.

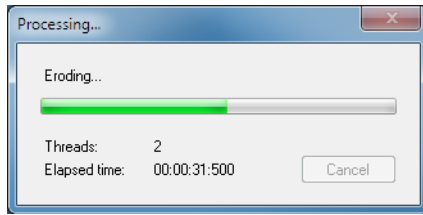
Reset lights – Reset the directional light to its default position.

Screenshot – Save a screenshot of the current preview viewport.

Effected/Original – Toggle the effected or original terrain heightmap view.

GeoTool Progress

While a GeoTool is performing its function on the heightmap, the progress dialog will be displayed.



The progress dialog displays the following information:

- The GeoTool function type that is executing.
- A progress meter bar that graphically depicts the current progress completion percentage.
- The number of processor threads used to perform the function, including the default interface thread.
- The elapsed execution time.

The Cancel button is available on some GeoTools during long execution times to allow cancelling of the function.

Adjust: Flip Horizontally

Flips the heightmap along the horizontal axis.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional heightmap memory allocation.

Adjust: Flip Vertically

Flips the heightmap along the vertical axis.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional heightmap memory allocation.

Adjust: Rotate 90° Clockwise

Rotates the heightmap 90 degrees clockwise.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional heightmap memory allocation.

Adjust: Rotate 90° Counterclockwise

Rotates the heightmap 90 degrees counter-clockwise.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional heightmap memory allocation.

Adjust: Rotate 180°

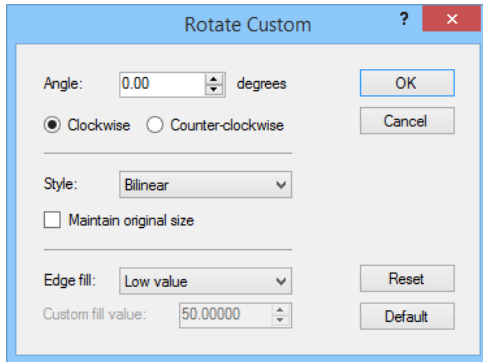
Rotates the heightmap 180 degrees.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional heightmap memory allocation.

Adjust: Rotate Custom

Rotates the heightmap by a custom number of degrees, with additional options. The rotation function features a high-precision accuracy rotation algorithm.



- Angle:** Specify the rotation angle in degrees. The valid range is -360.00 to 360.00.
- Clockwise:** The angle degrees are specified in the clockwise direction.
- Counter-clockwise:** The angle degrees are specified in the counter-clockwise direction.
- Style:** The rotation algorithm style. This affects the rotation quality.
- Nearest Neighbor = fast nearest-neighbor.
 - Bilinear = high-quality bilinear.
- Maintain original size:** Crop the rotated data to maintain the same dimensions as the original.
- Edge fill:** The method used to fill the edges around the rotation.
- Minimum = the heightmap minimum altitude.
 - Center = the heightmap center altitude.
 - Maximum = the heightmap maximum altitude.
 - Low value = the current heightmap low altitude.
 - Mean (average) = the current heightmap mean altitude (average).
 - Median (midpoint) = the current heightmap median altitude (midpoint).
 - Middle value = the current heightmap middle altitude.
 - Mode (common) = the current heightmap mode altitude (most common).
 - High value = the current heightmap high altitude.
 - Custom = the altitude value specified in the Custom fill value control.
 - Duplicate = duplicate the value around the edge.
 - Fold = fold the heightmap tiled around the edge.
 - Mirror = mirror the heightmap tiled around the edge.
 - Wrap = wrap the heightmap tiled around the edge.
- Custom fill value:** The custom edge fill altitude value to fill the edges around the rotated data.
- OK** Apply the custom rotation.
- Cancel** Cancel the dialog.
- Reset** Reset the dialog controls to their initial values.
- Default** Set the dialog controls to their default values.

Notes

This function does not fully and precisely preserve the original altitude data in its entirety.

This function requires 1 additional heightmap memory allocation.

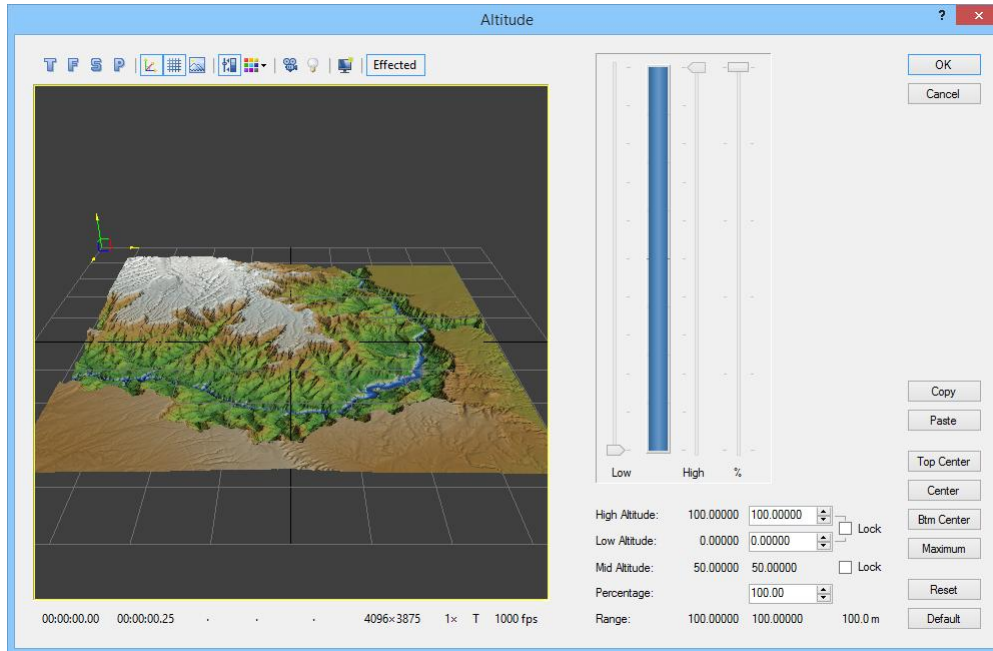
Rotation by 0 degrees and 360 degrees is no rotation, and simply returns with no change.

Rotation by 90, 180 and 270 degrees should be accomplished using the Rotate 90 and 180 functions instead.

The Rotate Custom dialog “short-circuits” the 90, 180, 270 operation and calls the appropriate rotation function.

Modify: Altitude

Allows for fine adjustments to the heightmap data's range and altitude.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
High Altitude:	Specify the high altitude value. High must be greater than Mid.
Low Altitude:	Specify the low altitude value. Low must be less than Mid.
Mid Altitude :	Specify the mid altitude value.
Percentage:	Specify the altitude range as a percentage of the original.
Range:	Displays the original and current altitude range and the range in real world units.
High/Low Lock:	Select this to lock the high and low value range difference.
Mid Lock:	Select this to lock the mid value, changes to high or low values are mirrored.
Low slider	Changes the low altitude value.
Altitude bar graph	Displays the original altitude range in gray and the current altitude range in blue.
High slider	Changes the high altitude value.
% percent slider	Changes the altitude range as a percentage of the original range.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Top Center	Move the entire heightmap to the top-center position.
Center	Move the entire heightmap to the center mid value of 50.0.
Btm Center	Move the entire heightmap to the bottom-center position.
Maximum	Change the heightmap range to the maximum range of low 0.0 through high 100.0.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

Changes to the altitude range does not preserve the original altitude data.

An altitude range move causes no loss in data resolution.

An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional heightmap memory allocations.

Modify: Altitude Center

Moves the heightmap data to the center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.

An altitude range move causes no loss in data resolution.

An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional heightmap memory allocations.

Modify: Altitude Top-Center

Moves the heightmap data to the top-center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.

An altitude range move causes no loss in data resolution.

An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional heightmap memory allocations.

Modify: Altitude Bottom-Center

Moves the heightmap data to the bottom center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.

An altitude range move causes no loss in data resolution.

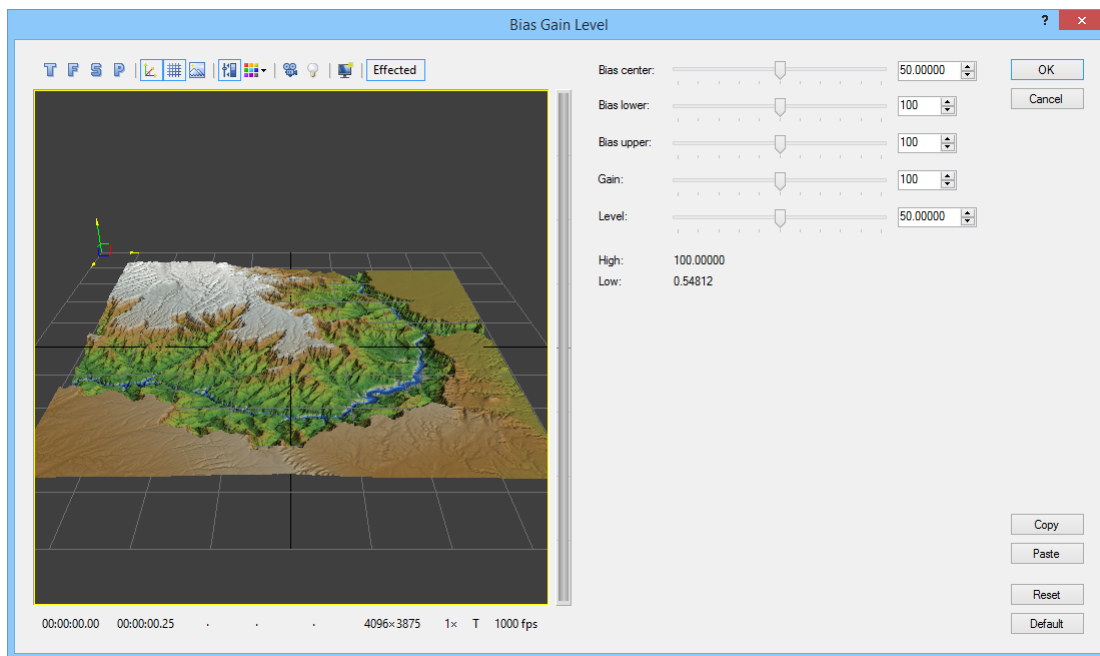
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional heightmap memory allocations.

Modify: Bias Gain Level

Professional Edition Only

Modifies the heightmap data along a bias curve, and gain and level values.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Altitude bar	Heightmap altitude display bar.
Bias center:	Specify the center altitude value that the bias curve will modify around.
Bias lower:	Specify the bias multiplier to the altitude values lower than Bias center. This can be used to effectively increase ocean depth for example.
Bias upper:	Specify the bias multiplier to the altitude values higher than Bias center. This can be used to effectively increase mountain height for example.
Gain:	Specify the altitude range gain as a percentage of the original.
Level:	Specify the center altitude level.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

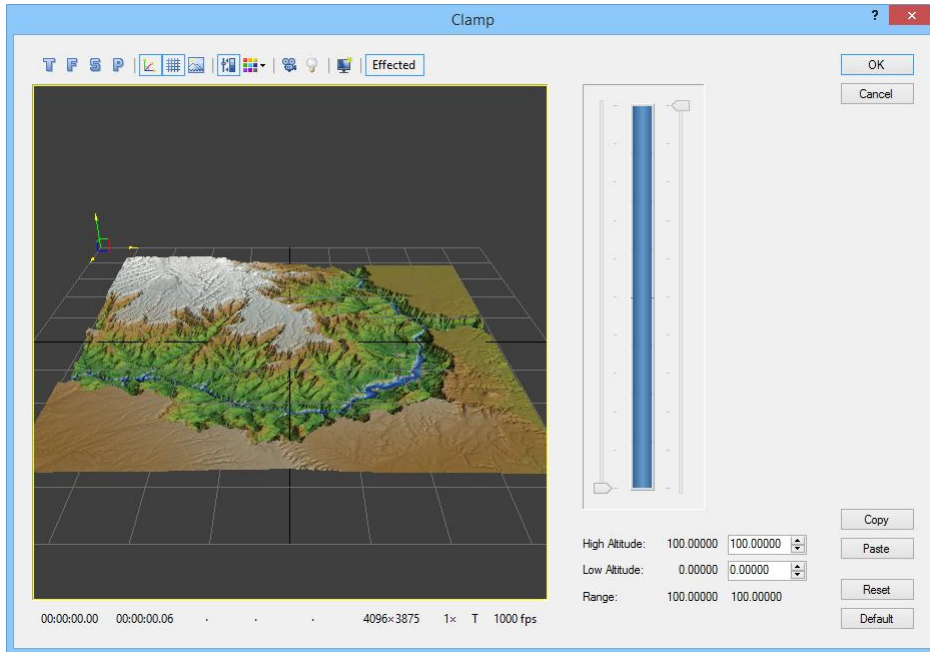
Notes

Changes to the altitude range does not preserve the original altitude data. An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional heightmap memory allocations.

Modify: Clamp

Clamps the heightmap altitude range within the specified high and low values. The heightmap data is hard-clipped at the clamp values.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Low slider	Changes the low altitude clamp value.
Altitude bar graph	Displays the original altitude range in gray and the clamp range in blue.
High slider	Changes the high altitude clamp value.
High Altitude:	Specify the high altitude clamp value. High must be greater than Low.
Low Altitude:	Specify the low altitude clamp value. Low must be less than High.
Range:	Displays the original and current altitude range.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data.

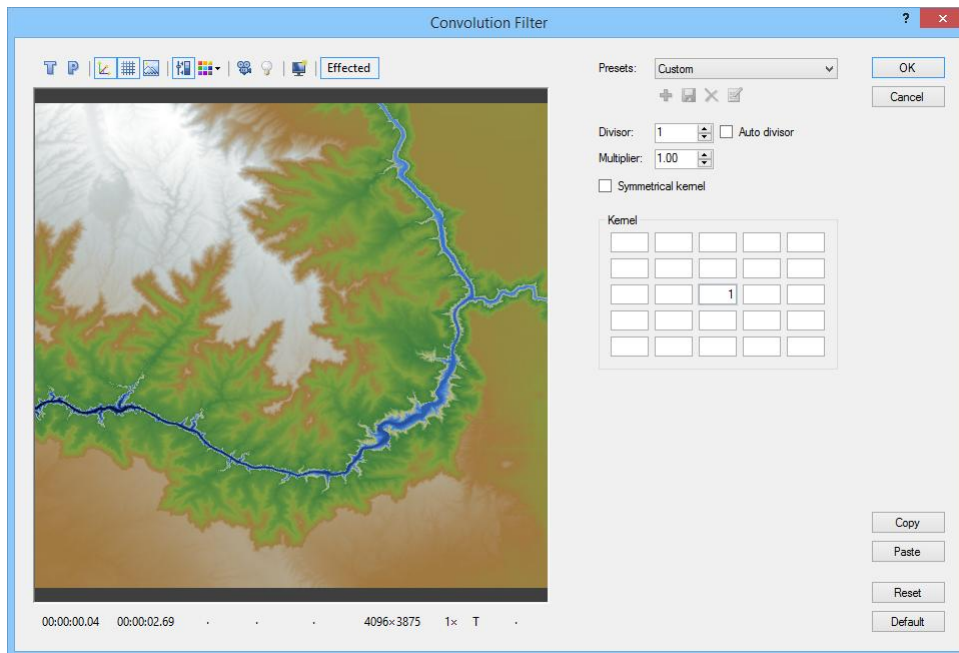
This function requires 0 additional heightmap memory allocations.

Modify: Convolution Filter

Professional Edition Only

Performs a user-defined fixed-window convolution filter algorithm over the heightmap data.

Convolution filters can provide a wide variety of adjustments to heightmap data including smoothing, sharpening, edge enhancing, smear offsetting, 3D embossing, jittering, and a wide variety of other data modifications.



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

Presets: Filter using these common preset settings.

Divisor: Specify the kernel divisor, which is typically the sum of all of the Kernel values.
Auto divisor: Automatically calculate the proper divisor based on the Kernel values.
Multiplier: A multiplier applied to the Kernel as an offset, either darkening or brightening the result.
Symmetrical: The Kernel value entries are set to the same value symmetrically around the center pixel.

Kernel boxes The weight multiplier for the center and outlying pixels. The center pixel is

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

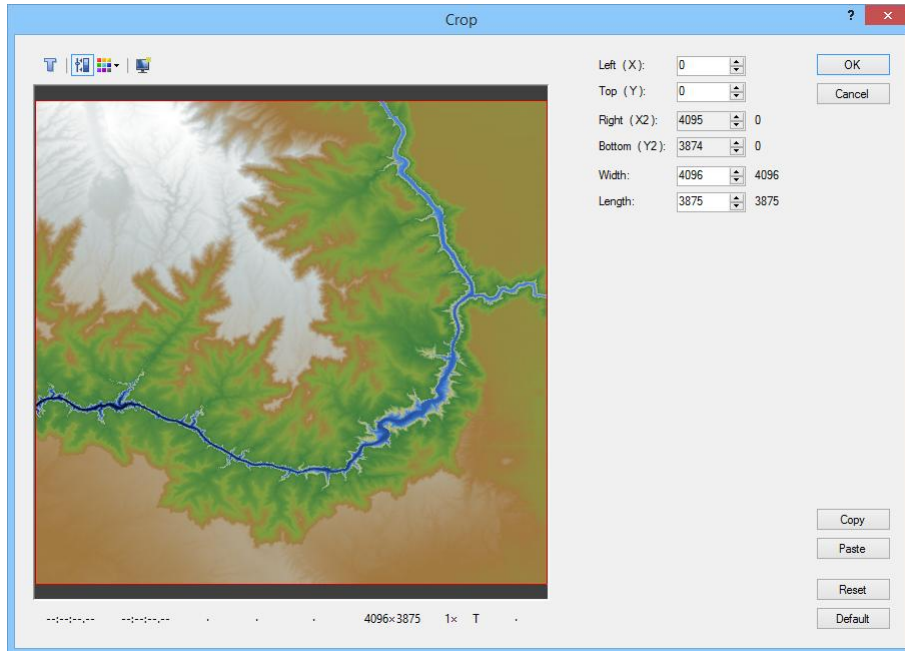
Notes

This function does not preserve the original altitude data.

This function requires 1 additional heightmap memory allocation.

Modify: Crop

Crop the edges of the heightmap to cut out a specific smaller area.



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

Left (X): The left coordinate of the crop region.
Top (Y): The top coordinate of the crop region.
Right (X2): The right coordinate of the crop region. This value is read only and cannot be changed.
Bottom (Y2): The bottom coordinate of the crop region. This value is read only and cannot be changed.
Width: The width of the crop region.
Length: The length of the crop region.

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

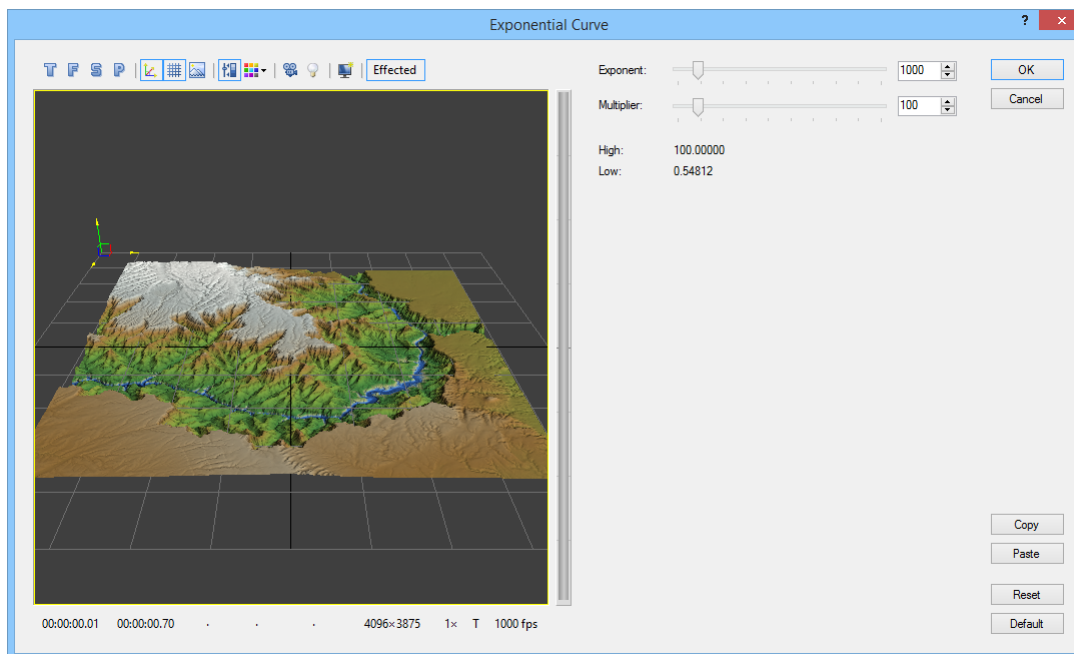
Notes

This function requires 1 additional heightmap memory allocation.

Modify: Exponent

Professional Edition Only

Multiplies the heightmap altitude data by the exponent value.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Altitude bar	Heightmap altitude display bar.
Exponent:	The exponent value.
Multiplier:	The multiplier value.
High:	The altitude high value.
Low:	The altitude low value.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

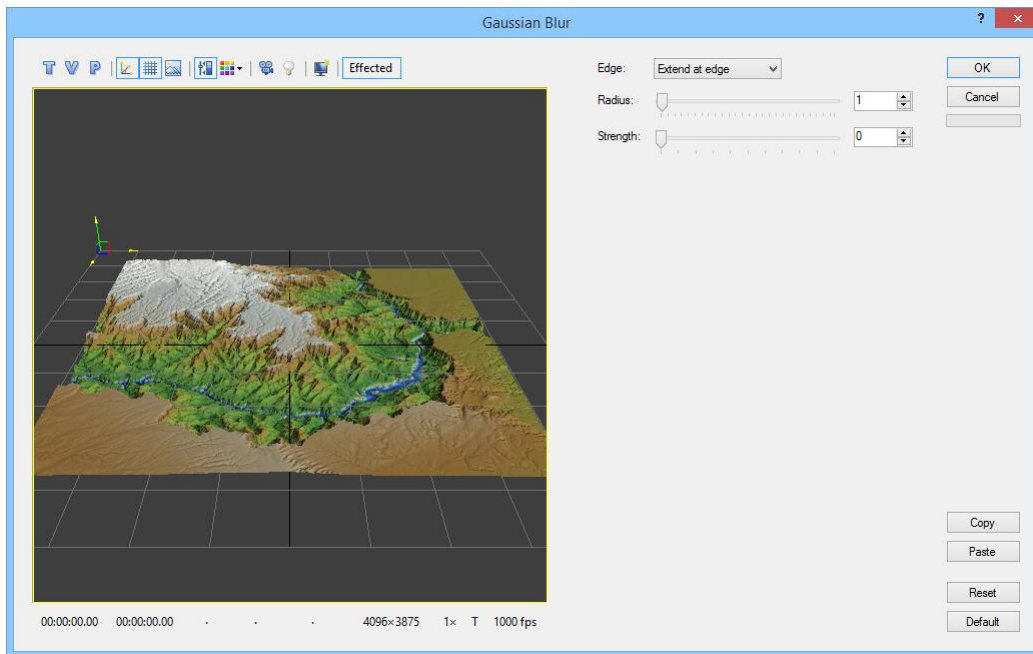
Notes

This function requires 0 additional heightmap memory allocation.

Modify: Gaussian Blur

Professional Edition Only

Smooths the heightmap using a gaussian blur kernel.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Edge:	The method for managing the gaussian kernel values along the heightmap edges.
Radius:	The gaussian kernel radius.
Strength:	The gaussian blur strength.
OK	Apply the settings.
Cancel	Cancel the dialog.
Build progressbar	Display the build progress for long tasks.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

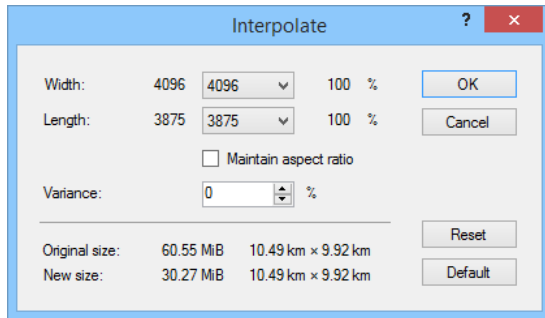
This function requires 1 additional heightmap memory allocation.

Modify: Interpolate

Professional Edition Only

Increase the dimensions of the heightmap using a linear interpolation algorithm.

Interpolation is different from Resample in that it only supports enlargement multiples such as 200%, 300%, 400%, 500%, etc. Interpolation retains all of the original altitude sample values and inserts "interpolated" altitude values to provide an increase in dimensions resolution while maintaining the exact original data.



Width:	The desired new width dimension. This can only be an integer multiple of the original.
Length:	The desired new length dimension. This can only be an integer multiple of the original.
Maintain aspect ratio:	Locks the width and length controls to maintain the same aspect ratio as the original.
Variance:	Applies a random variance to the interpolated altitude values placed between the original.

Original size:	Displays the original size information.
New size:	Displays the new size information.

OK	Apply the settings.
Cancel	Cancel the dialog.

Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

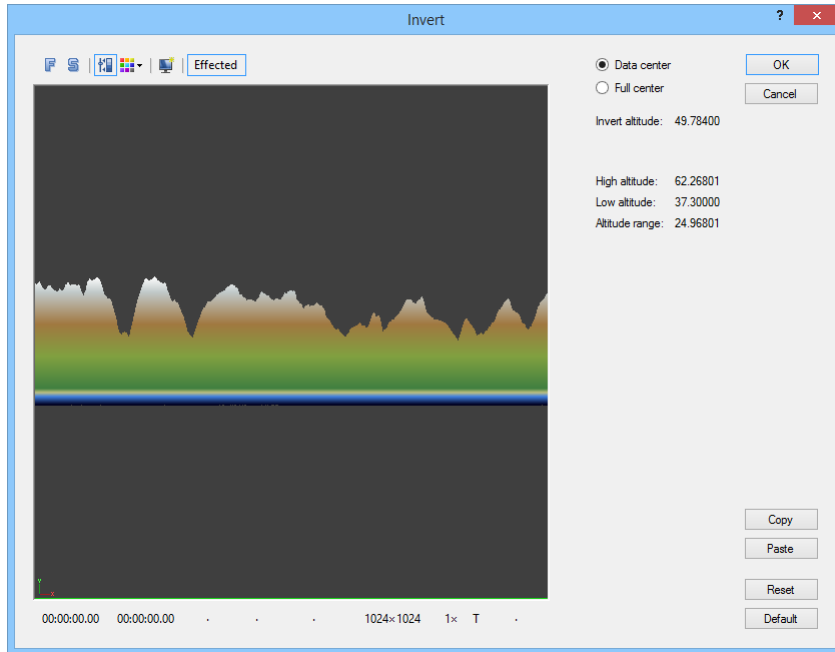
Notes

To perform a "cut" on the heightmap to a smaller dimension while retaining the exact sample point altitudes for those points that are not removed, use the Resample function with the Fast Quality to an equal smaller divisor dimension such as 50%, 25%, etc.

This function requires 1 additional heightmap memory allocation.

Modify: Invert

Inverts the heightmap data around the specified center point.
This effectively flips the heightmap data, turning hills into valleys, and valleys into hills.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Data center:	Invert at the heightmap's data center median altitude.
Full center:	Invert at the full range center altitude of 50.0.
Invert altitude:	The current invert altitude.
High altitude:	The heightmap high altitude.
Low altitude:	The heightmap low altitude.
Altitude range:	The heightmap altitude range.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

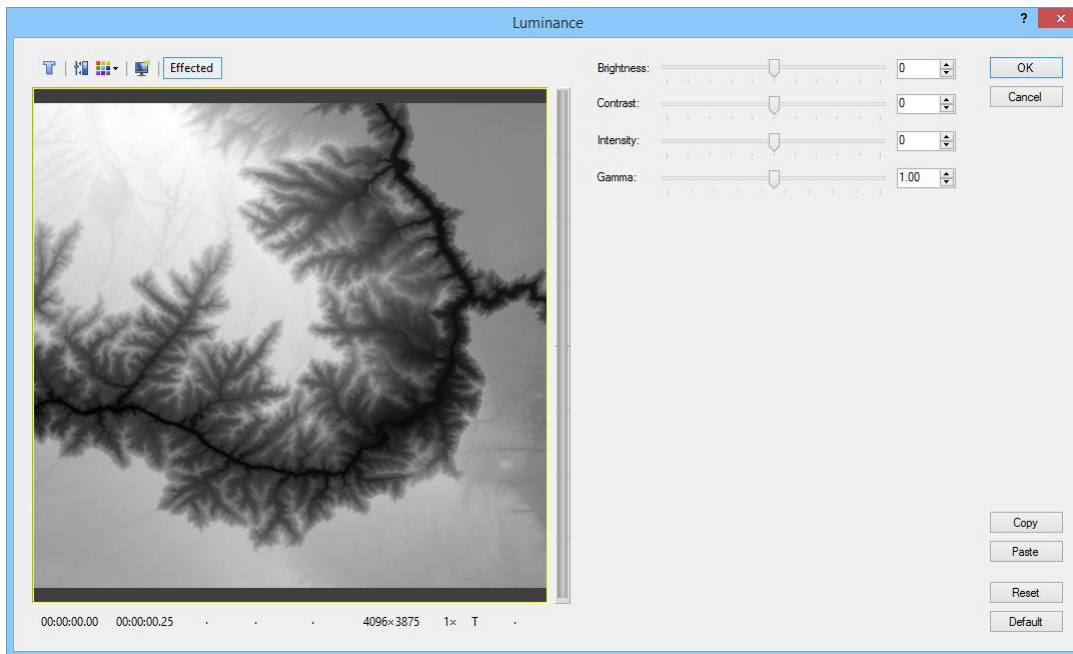
Notes

This function requires 0 additional heightmap memory allocations.

Modify: Luminance

Professional Edition Only

Changes the Brightness, Contrast, Intensity and Gamma of a Heightmap.



Preview toolbar	A set of toolbar buttons for preview options.		
Preview	Provides a thumbnail preview of the altitude settings.		
Preview statusbar	Preview information status.		
Altitude bar	Heightmap altitude display bar.		
Brightness:	Adjust the image brightness.	0 is no change.	The range is -100 to +100.
Contrast:	Adjust the image contrast.	0 is no change.	The range is -100 to +100.
Intensity:	Adjust the image intensity.	0 is no change.	The range is -100 to +100.
Gamma:	Adjust the image gamma.	1.00 is no change.	The range is 0.1 to 10.0.
OK	Apply the settings.		
Cancel	Cancel the dialog.		
Copy	Copy the dialog properties to the system clipboard.		
Paste	Paste the dialog properties from the system clipboard.		
Reset	Reset the dialog controls to their initial values.		
Default	Set the dialog controls to their default values.		

Notes

This function does not preserve the original altitude data.

The Gamma function requires 1 additional array memory allocation.

Luminance adjustments are normally used on masks or weightmaps.

Intensity is a curve-weighted brightness that typically complements the Contrast adjustment.

Modify: Normalize

Changes the altitude of the Heightmap to the maximum range of 0.0 to 100.0.

This function occurs immediately with no options or settings.

Notes

This function does not preserve the original altitude data.

This function requires 0 additional heightmap memory allocations.

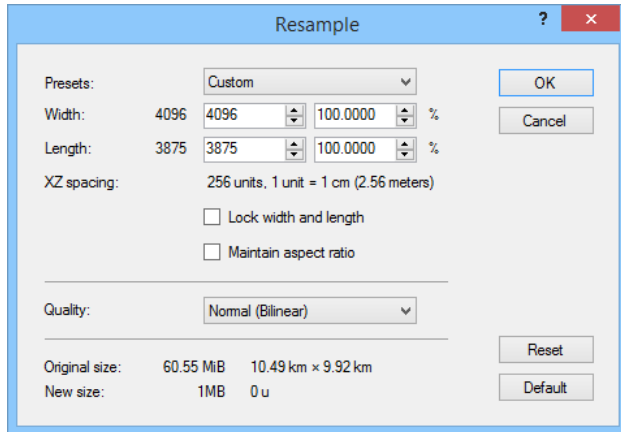
Modify: Resample

Allows increasing or decreasing the width and length dimensions of the heightmap.

The new dimensions can be any valid values in the range of 2x2 up to the largest supported size.

The heightmap data may be filtered to provide a more accurate and smoother resampling depending on the Quality value chosen.

Note that resampling does not fully preserve the original altitude data in its entirety, but provides the closest matching altitudes for the given downsampling or upsampling dimensions ratio. To accurately preserve the original heightmap data when upsampling by dimension multiples, use the Interpolate function.



Presets:	Resample using these common preset settings. Downsample to smaller common power-of-two sizes or percentages. Upsample to larger common power-of-two sizes or percentages.
Width:	The new custom width.
Length:	The new custom length.
XZ Spacing:	The current engine XZ spacing units.
Lock width and length:	Locks the width and length controls to maintain the same values.
Maintain aspect ratio:	Locks the width and length controls to maintain the same aspect ratio as the original.
Quality:	Specifies the resampling quality, or the overall accuracy of the resampling algorithm. Fast: very accurate nearest-neighbor. Normal: variable-window averaging downsample and bilinear upsample. High: large window bicubic convolution filter. Best: large window lanczos filter.
Original size:	Displays the original memory size and unit scale dimensions.
New size:	Displays the new memory size and unit scale dimensions.
OK	Apply the settings.
Cancel	Cancel the dialog.
UDK	Choosing this button will display the UDK Landscape Sizes dialog. This button will be available only when UDK Landscape is enabled in the Preferences.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

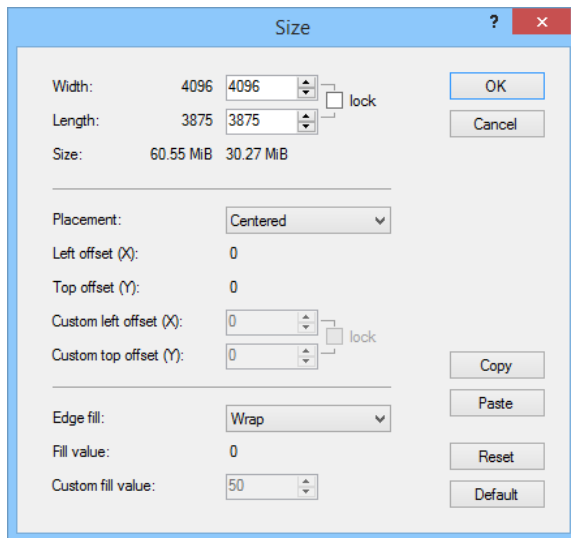
This function requires 1 additional heightmap memory allocation.

Modify: Size

Change the size dimensions of the heightmap.

For larger sizes on either dimension, the new area is filled with the specified Edge fill style.

For smaller sizes on either dimension, the original heightmap is cropped.



Width: The new Width value.
Length: The new Length value.
Lock: Lock the new Width and Length values.
Size: Displays the original and new heightmap sizes

Placement: Specify the location of the original heightmap data within the new size dimensions.
- Locations: Specify the location of the original heightmap data using these preset locations.
- Custom: Specify the original heightmap data location using the Left and Top offsets.

Left offset: The offset from the left that the original heightmap data is located in the new size.

Top offset: The offset from the top that the original heightmap data is located in the new size.

Custom Left offset: The custom offset from the left that the original heightmap data is located in the new size.

Custom Top offset: The custom offset from the top that the original heightmap data is located in the new size.

Lock: Lock the Custom Left offset and Custom Top offset values.

Edge fill: The style of edge fill if the new size is larger.
- Minimum = the heightmap minimum altitude.
- Center = the heightmap center altitude.
- Maximum = the heightmap maximum altitude.
- Low value = the current heightmap low altitude.
- Mean (average) = the current heightmap mean altitude (average).
- Median (midpoint) = the current heightmap median altitude (midpoint).
- Middle value = the current heightmap middle altitude.
- Mode (common) = the current heightmap mode altitude (most common).
- High value = the current heightmap high altitude.
- Custom = the altitude value specified as the Custom fill value.
- Duplicate = duplicate the value around the edge.
- Fold = fold the heightmap tiled around the edge.
- Mirror = mirror the heightmap tiled around the edge.
- Wrap = wrap the heightmap tiled around the edge.

Fill value: The fill value.

Custom fill value: The custom fill value.

OK Apply the settings.

Cancel Cancel the dialog.

Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their default values.
Default	Set the dialog controls to their default values.

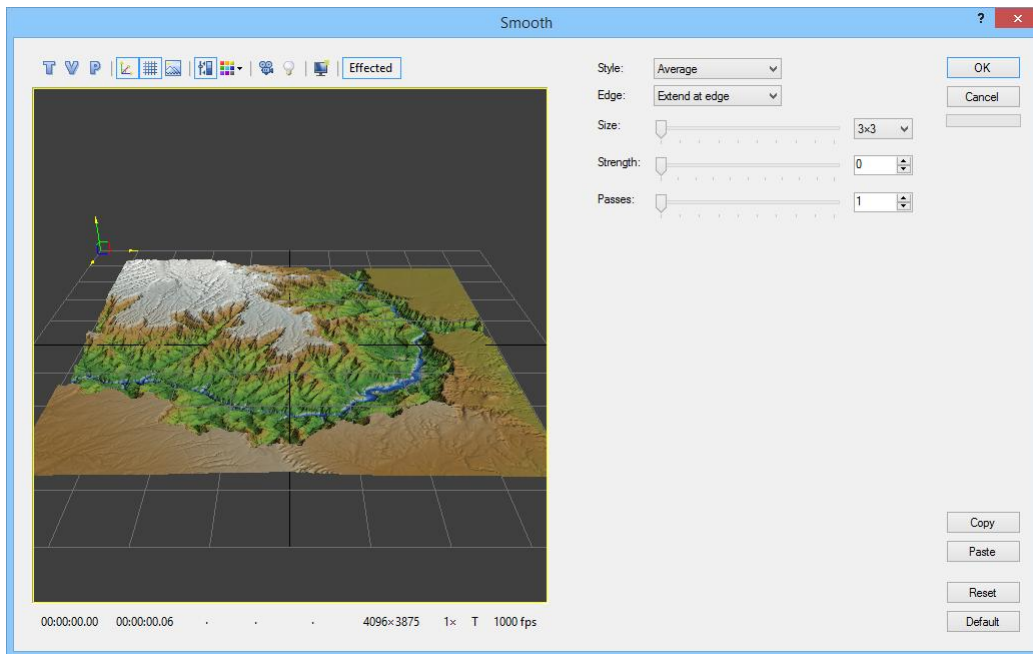
Notes

The Left and Top offset values in conjunction with the Edge fill style of Mirror allows the heightmap to be offset in any direction by the specified number of pixels.

This function requires 1 additional heightmap memory allocation.

Modify: Smooth

Smoothens the surface of the heightmap by adjusting the altitudes to remove steeper inclines and angles.



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

Style: The smooth style algorithm.
Average: Performs a variable-window averaging.
Conservative: Performs a variable-window conservative smooth.
Gaussian: Performs a variable-window gaussian weighted smooth.
Median: Performs a variable-window median value smooth.
Middle: Performs a variable-window middle value smooth.
Radial: Performs a variable-window radial smooth.

Size: The size of the smoothing window.
Strength: The applied smoothing strength.
Passes: The number of smoothing passes.

OK Apply the settings.
Cancel Cancel the dialog.
Build progressbar Display the build progress for long tasks.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data.

This function requires 1 additional heightmap memory allocation.

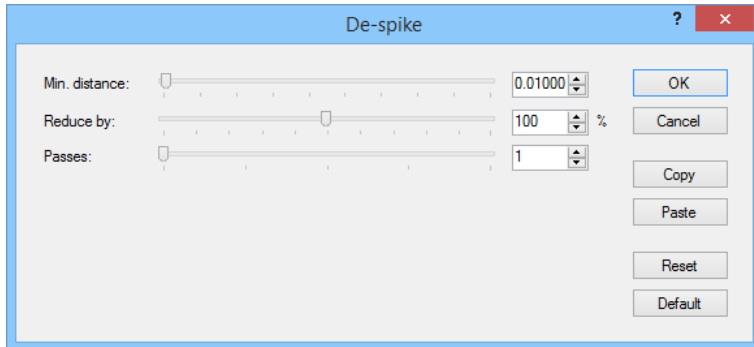
The Gaussian style smooth is using a true full-radius window algorithm for higher quality. This provides a more accurate and pleasing smooth but at a cost of more time. Also see the Modify Gaussian Blur modifier.

Transform: De-spike

Professional Edition Only

Reduce or remove single-sample spikes in the heightmap.

This is normally used to reduce single sample spikes in heightmaps created with the Ridged Noise generator.



Min. distance: The minimum distance in altitude difference before a sample is classified as a spike.
Reduce by: The percentage of the distance difference to reduce the spike by.
Passes: The number of de-spiking passes.

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data.

This function requires 0 additional heightmap memory allocations.

The Minimum distance value is the altitude distance difference between a heightmap sample point and all of the sample points that surround it, ie. its neighbors. If a sample point is 20 units above all of its surrounding neighbor samples, it is classified as a spike with a Minimum distance of 20. Setting Minimum distance to 20 will catch all spike samples that are 20 or more units higher than all of their surrounding neighbors.

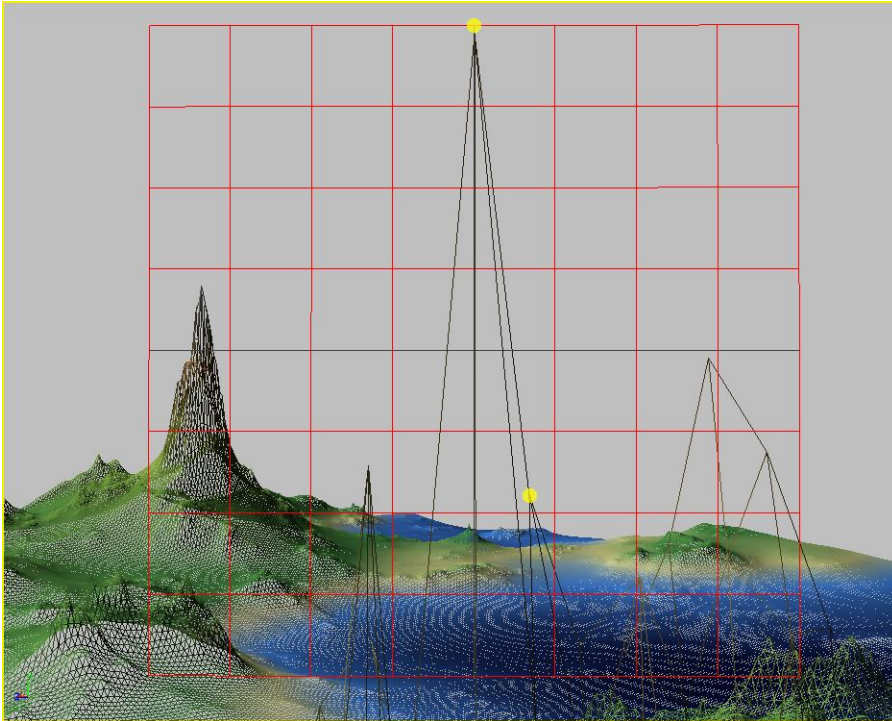
The Minimum distance value is not in world units but is in heightmap altitude values. To convert from the heightmap altitude values to the current 3D Editor vertex-based world units, divide the heightmap altitude by 256, and multiply it by the current Units Y Spacing. For a Units Y Spacing of 256, the heightmap values and world units are equal.

The number of de-spiking passes is only relevant if the Reduce by percentage is less than or greater than 100%. For example, if the heightmap contains a number of spikes that are comprised of two side-by-side samples at varying heights, and the Reduce by value is set at 150%, the first pass will move the taller of the two taller samples down by 150%, making it shorter than the other sample; the second pass will then move the other taller sample down by 150%.

A typical De-spiking routine to reduce many spikes may be a sequence of:

- 50 Min. distance, 150% Reduce by, 1 Pass
- 10 Min. distance, 100% Reduce by, 1 Pass
- 1 Min. distance, 100% Reduce by, 1 Pass

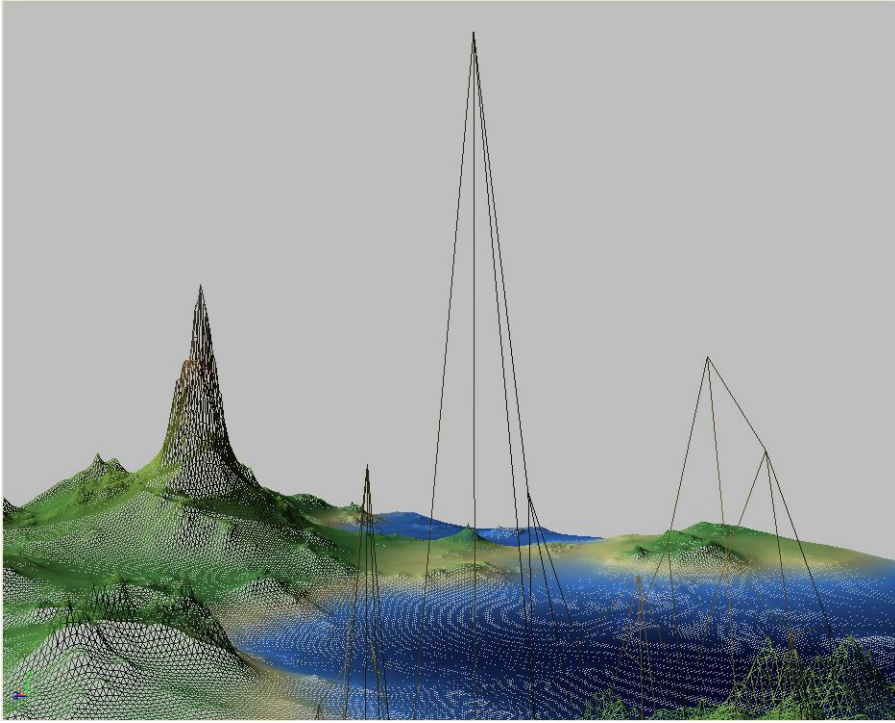
Additional smoothing of spiked areas can be accomplished by using a steep-Slope Mask with the Smooth function in the World Stack.



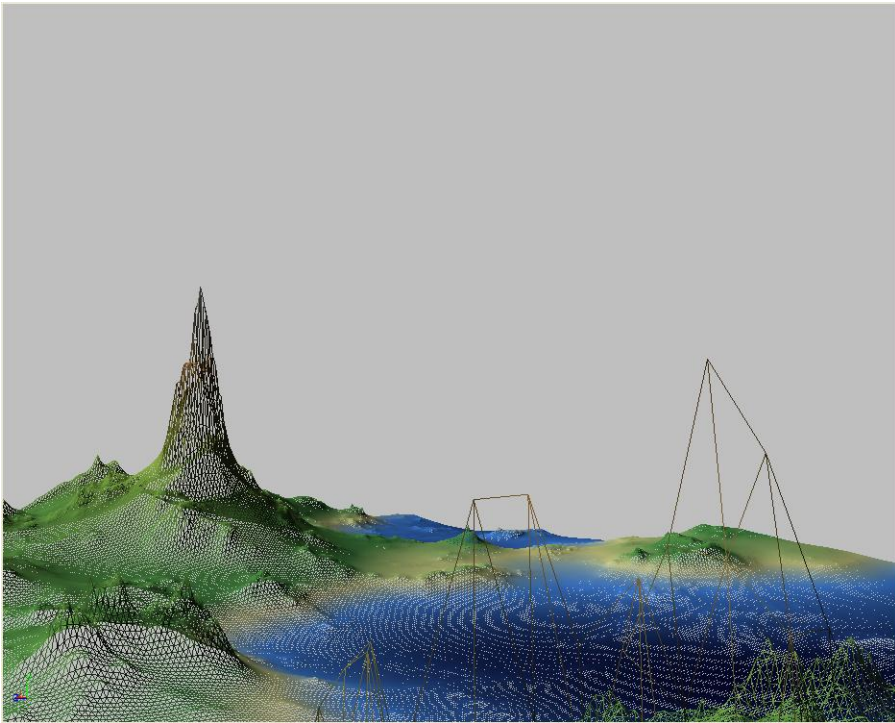
In this example, a 256 spacing user grid (in red) has been positioned at a spike in the terrain. The two yellow dots show the top-most spike vertex and the closest neighboring vertex below the spike. With a Units Y Spacing of 256, the altitude distance difference between these two heightmap samples is almost 6 grid cells which is approximately 6.0 in heightmap altitude.

A De-spike *Minimum distance* value of 5.0 will easily remove this spike.

A *Reduce by* value of 100% will lower the top spike vertex down to the next closest neighbor vertex's altitude.



Before De-spiking.

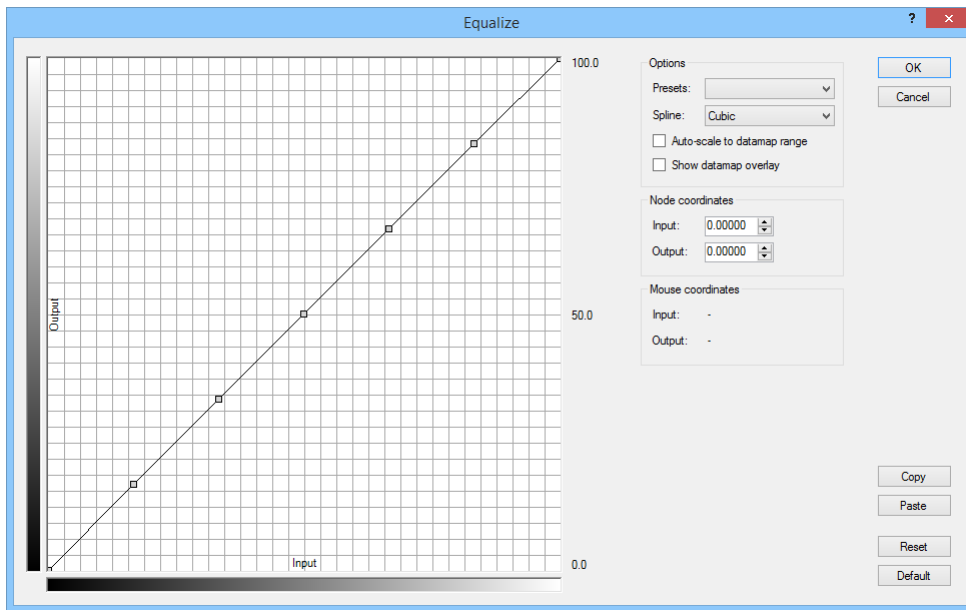


After De-spiking.

Transform: Equalize

Professional Edition Only

Modifies the .heightmap data based on the spline equalization graph.



Equalize graph	Provides a visual editor for the graph spline control points.
Presets:	A set of common preset equalize graphs.
Spline:	Chooses from a set of specific spline interpolation algorithm types.
Auto-scale:	Automatically scales the equalize to the current heightmap range instead of 0-to-100.
Show overlay:	Displays the current heightmap range overlaid on the graph as a gray area.
Node Input:	The currently selected spline control point node input value.
Node Output:	The currently selected spline control point node output value.
Mouse Input:	The current mouse coordinates along the input scale.
Mouse Output:	The current mouse coordinates along the output scale.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data.

This function requires 0 additional heightmap memory allocations.

The available spline types vary in their accuracy and smoothness, with Cubic as low quality, Catmull-Rom as medium quality, and Hermite as high quality.

Transform:Erosion

Applies an erosion algorithm over the heightmap to simulate real-world erosion effects.

Some of the erosion algorithms are extremely computation and memory intensive, and can therefore take many hours to complete on large heightmaps. It is always best to try a less intense erosion first to determine whether it produces the desired effects.

The erosion algorithms are not a fast immediate real-time operation, so the Preview button must be used to generate an erosion preview, followed by a wait until the erosion function is complete, as indicated on the preview progressbar.

Different erosion types produce different erosion results. Each erosion type is suited for specific visual looks and different terrain layouts.

Masks are created during the erosion process, which can be saved as files and used for texture weightmaps, splatmap textures, or image editing masks.

Notes

This function does not preserve the original altitude data.

The Hydraulic Erosion function requires 2 masks and 4 floating-point temporary arrays.

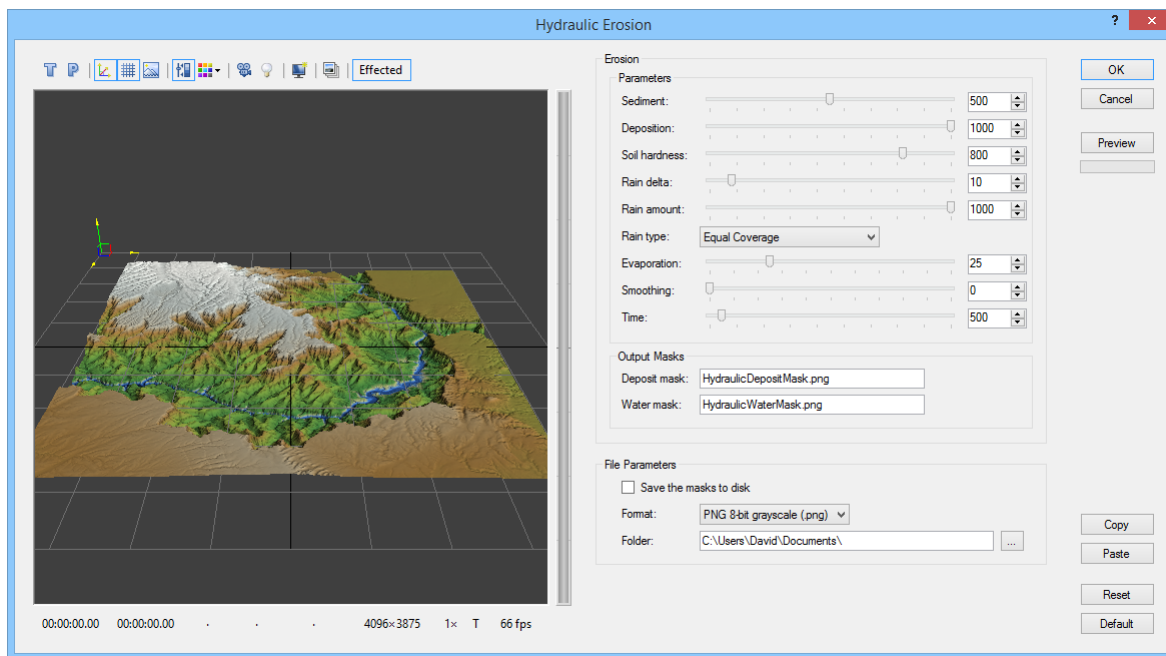
The Slope Erosion function requires 1 mask and 5 floating point temporary arrays.

The Thermal Erosion function requires 1 mask and 2 floating point temporary arrays.

Hydraulic Erosion

Professional Edition Only

Hydraulic erosion simulates rainfall with soil erosion and movement from higher altitudes to lower altitudes.



- | | |
|-------------------|--|
| Preview toolbar | A set of toolbar buttons for preview options. |
| Preview | Provides a thumbnail preview of the altitude settings. |
| Preview statusbar | Preview information status. |
| Altitude bar | Heightmap altitude display bar. |
| Sediment: | The amount of sediment that the water can carry. |
| Deposition: | The sediment deposit rate. |
| Soil hardness: | The rate at which soil converts to sediment. |
| Rain delta: | The amount of time between each rainfall. |
| Rain amount: | The amount of rain that falls for each time step. |
| Rain type: | The rainfall type: <ul style="list-style-type: none">- Equal coverage = the rain amount is equal over the entire map.- Adiabatic weighted = more rainfall at higher altitudes (natural).- Inverse Adiabatic weighted = more rainfall at lower altitudes (unnatural). |
| Evaporation: | The rate of rain water evaporation at each time step. |
| Smoothing: | The amount of smoothing applied after the erosion. |
| Time: | The number of erosion passes to simulate the amount of time passed. |
| Deposit mask: | The Deposit mask file name. |
| Water mask: | The Water mask file name. |
| Save the masks | Save the masks to disk. |
| Format: | The mask file format to save as. |
| Folder: | The file folder where the masks are saved. |
| OK | Apply the settings. |
| Cancel | Cancel the dialog. |
| Preview | Execute the erosion preview. |
| Build progressbar | Display the build progress for long tasks. |

Copy
Paste

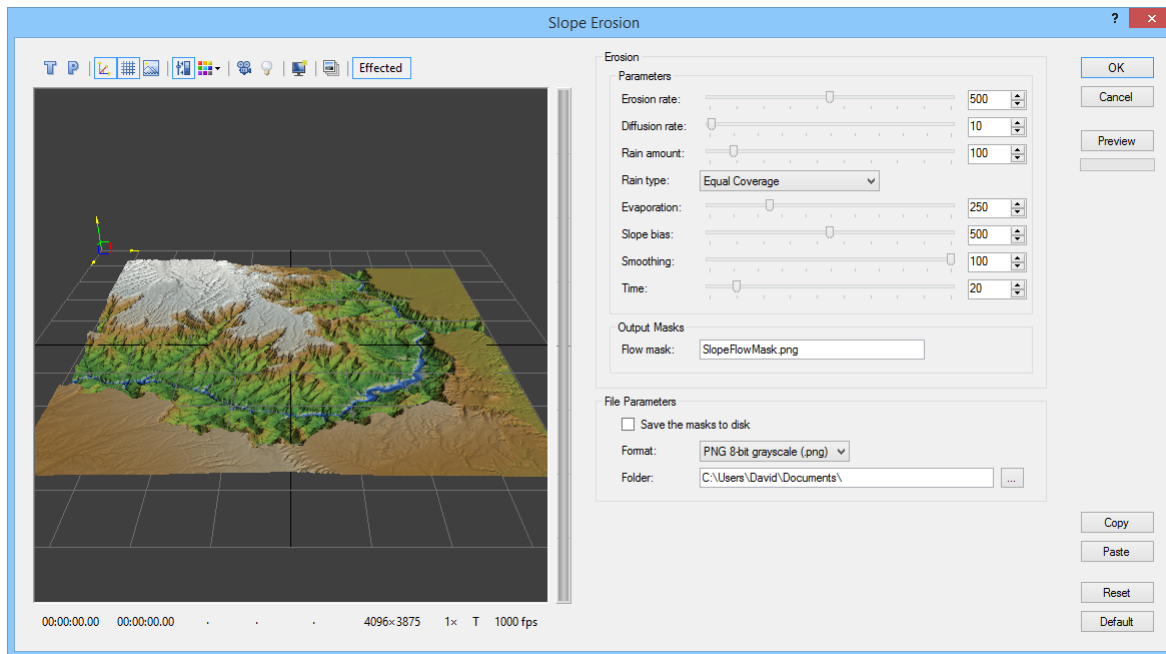
Copy the dialog properties to the system clipboard.
Paste the dialog properties from the system clipboard.

Reset
Default

Reset the dialog controls to their initial values.
Set the dialog controls to their default values.

Slope Erosion

Slope erosion simulates water flowing down the slope of each patch of the terrain, carving a fluvial path downhill.



- Preview toolbar A set of toolbar buttons for preview options.
- Preview Provides a thumbnail preview of the altitude settings.
- Preview statusbar Preview information status.
- Altitude bar Heightmap altitude display bar.

- Erosion rate: The rate of cellular erosion for each time step.
- Diffusion rate: The rate of cellular diffusion for each time step.
- Rain amount: The amount of rain that falls for each time step.
- Rain type: The rainfall type:
 - Equal coverage = the rain amount is equal over the entire map.
 - Adiabatic weighted = more rainfall at higher altitudes (natural).
 - Inverse Adiabatic weighted = more rainfall at lower altitudes (unnatural).
- Evaporation: The rate of rain water evaporation for each time step.
- Slope bias: Erosion slope bias, how the water follows the slope of the terrain.
- Smoothing: The amount of smoothing applied after the erosion.
- Time: The number of erosion passes to simulate the amount of time passed.

- Flow mask: The Flow mask file name.

- Save the masks Save the masks to disk.
- Format: The mask file format to save as.
- Folder: The file folder where the masks are saved.

- OK Apply the settings.
- Cancel Cancel the dialog.

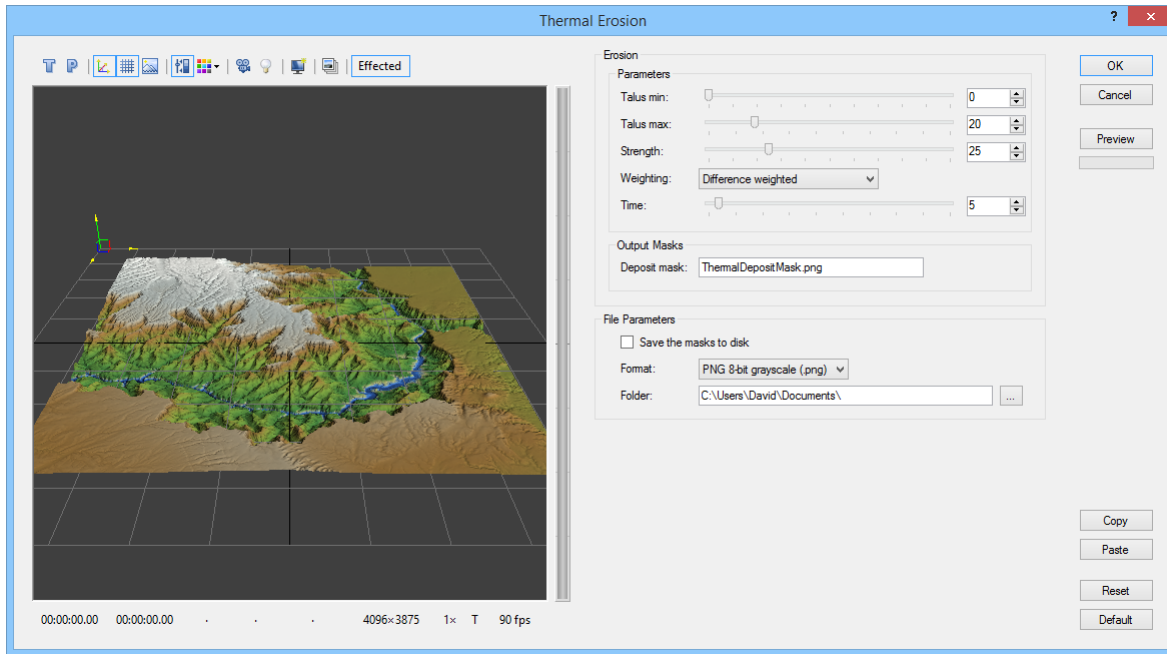
- Preview Execute the erosion preview.
- Build progressbar Display the build progress for long tasks.

- Copy Copy the dialog properties to the system clipboard.
- Paste Paste the dialog properties from the system clipboard.

- Reset Reset the dialog controls to their initial values.
- Default Set the dialog controls to their default values.

Thermal Erosion

Thermal erosion simulates the breaking up of soil due to thermal expansion and contracting.



- Preview toolbar A set of toolbar buttons for preview options.
- Preview Provides a thumbnail preview of the altitude settings.
- Preview statusbar Preview information status.
- Altitude bar Heightmap altitude display bar.

- Talus min: The minimum altitude difference before erosion occurs.
- Talus max: The maximum altitude difference when erosion occurs.
- Strength: The erosion strength
- Weighting: The erosion deposit weighting type:
 - Difference weighted.
 - Maximum average weighted.
- Time: The number of erosion passes to simulate the amount of time passed.

- Deposit mask: The Deposit mask file name.

- Save the masks Save the masks to disk.
- Format: The mask file format to save as.
- Folder: The file folder where the masks are saved.

- OK Apply the settings.
- Cancel Cancel the dialog.

- Preview Execute the erosion preview.
- Build progressbar Display the build progress for long tasks.

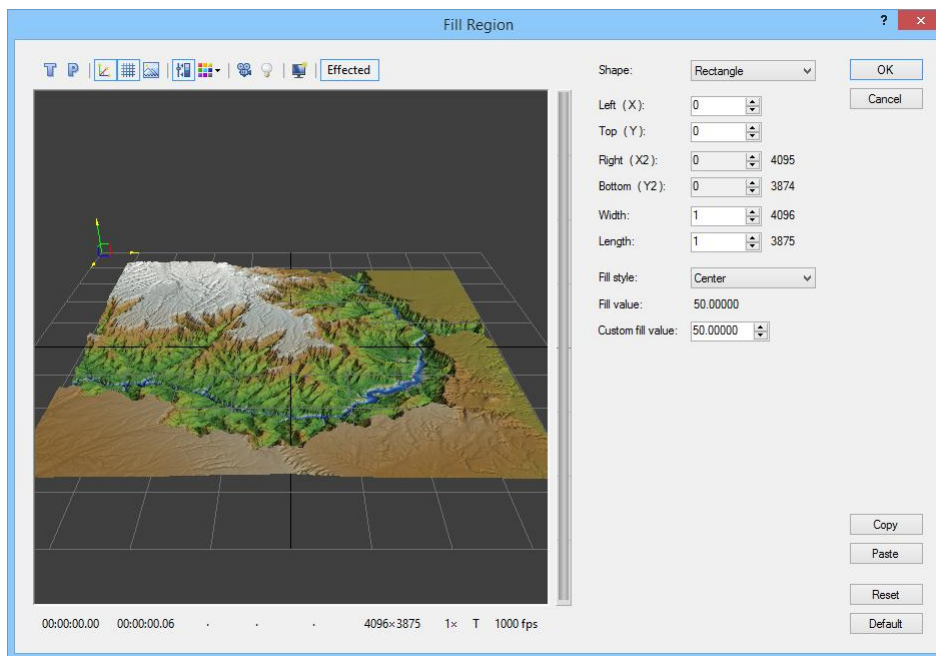
- Copy Copy the dialog properties to the system clipboard.
- Paste Paste the dialog properties from the system clipboard.

- Reset Reset the dialog controls to their initial values.
- Default Set the dialog controls to their default values.

Transform: Fill Region

Professional Edition Only

Fill the selected region with the specified altitude value.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Altitude bar	Heightmap altitude display bar.
Shape:	The fill region shape.
Left (X):	The fill region left coordinate.
Top (Y):	The fill region top coordinate.
Right (X2):	The fill region right coordinate.
Bottom (Y2):	The fill region bottom coordinate.
Width:	The fill region width.
Length:	The fill region length.
Fill style:	The fill style: <ul style="list-style-type: none">- Minimum = the heightmap minimum altitude.- Center = the heightmap center altitude.- Maximum = the heightmap maximum altitude.- Low value = the current heightmap low altitude.- Middle value = the current heightmap middle altitude.- High value = the current heightmap high altitude.- Mean (average) = the current heightmap mean altitude (average).- Median (midpoint) = the current heightmap median altitude (midpoint).- Mode (common) = the current heightmap mode altitude (most common).- Custom = the altitude value specified in the Custom fill value control.
Fill value:	The fill value.
Custom fill value:	The custom fill value.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.

Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

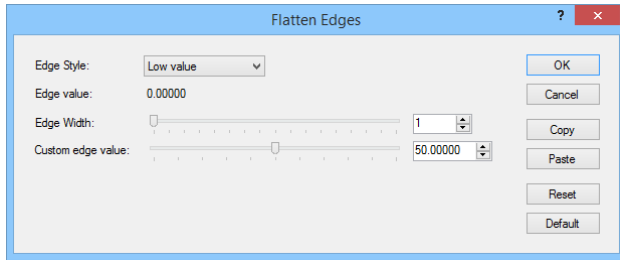
Notes

This function does not preserve the original altitude data within the fill region.

This function requires 0 additional heightmap memory allocations.

Transform: Flatten Edges

Changes the outer edges of the heightmap to the specified fixed altitude value.



Edge style: The edge flatten altitude style presets:

- Minimum = the heightmap minimum altitude.
- Center = the heightmap center altitude.
- Maximum = the heightmap maximum altitude.
- Low value = the current heightmap low altitude.
- Middle value = the current heightmap middle altitude.
- High value = the current heightmap high altitude.
- Mean (average) = the current heightmap mean altitude (average).
- Median (midpoint) = the current heightmap median altitude (midpoint).
- Mode (common) = the current heightmap mode altitude (most common).
- Custom = the altitude value specified in the Custom fill value control.

Edge value: The edge value
Edge width: The number of samples (pixels or vertices) around the edges to flatten to the edge altitude.
Custom edge value: The custom edge altitude value to flatten the edges to.

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data around the heightmap edges.

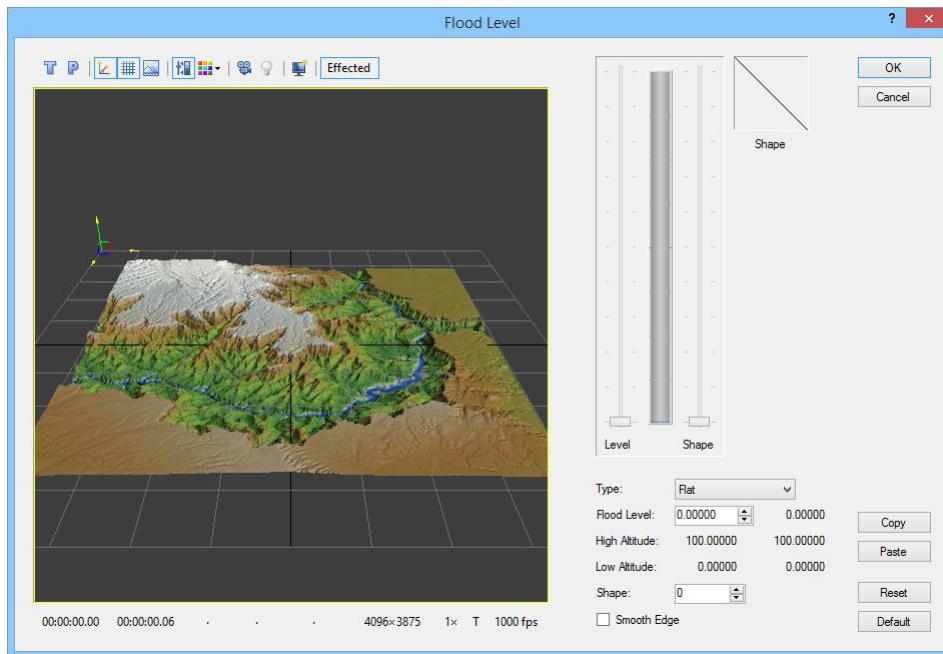
This function requires 0 additional heightmap memory allocations.

If the source heightmap is larger than the terrain rendering LOD, then the front and right edge may not visually look like it is flattened to the specified altitude. This is due to the resampling function that occurs to the heightmap data before it is converted to the viewport rendering mesh.

Transform: Flood Level

Professional Edition Only

Simulates flooding the heightmap with water.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Type:	The flood level shape type. <ul style="list-style-type: none">- Flat: the flood level is clipped flat at the level altitude.- Curved: the flood level is angled at the level altitude by the shape percent.
Flood Level:	The positive offset altitude where the flood level starts.
High altitude:	The terrain high altitude.
Low altitude:	The terrain low altitude.
Shape:	The percent that the altitudes below Level are flooded. Curved Type only.
Smooth Edge:	Applies smoothing around the flood level edge. Flat or Curve 100 only.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

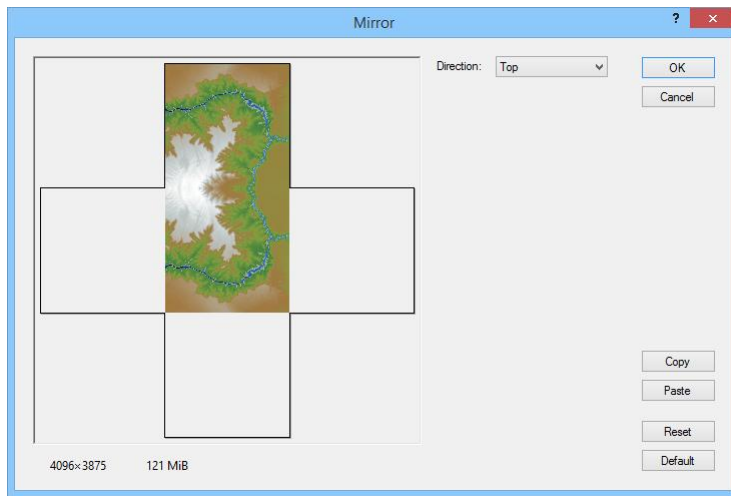
This function does not preserve the original altitude data.

This function requires 1 additional heightmap memory allocations if Smooth Edge is enabled.

Transform: Mirror

Professional Edition Only

Mirrors the heightmap on one of its four sides, typically for symmetrical map designs.



Preview	Provides a medium-resolution preview of the mirror settings. The preview squares can be clicked on to select that mirror side.
Preview statusbar	Shows the heightmap resolution and memory usage.
Direction:	Specifies the heightmap side to mirror to.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

Notes

The real-time preview display can also be used to select the desired mirror direction using the mouse. Hover the mouse over any mirror side to choose that direction, then click to accept the choice.

The real-time preview display does not show an aspect-correct thumbnail version of the source heightmap. This is by design so that heightmaps with very tall or very wide aspect ratios can still be previewed more easily.

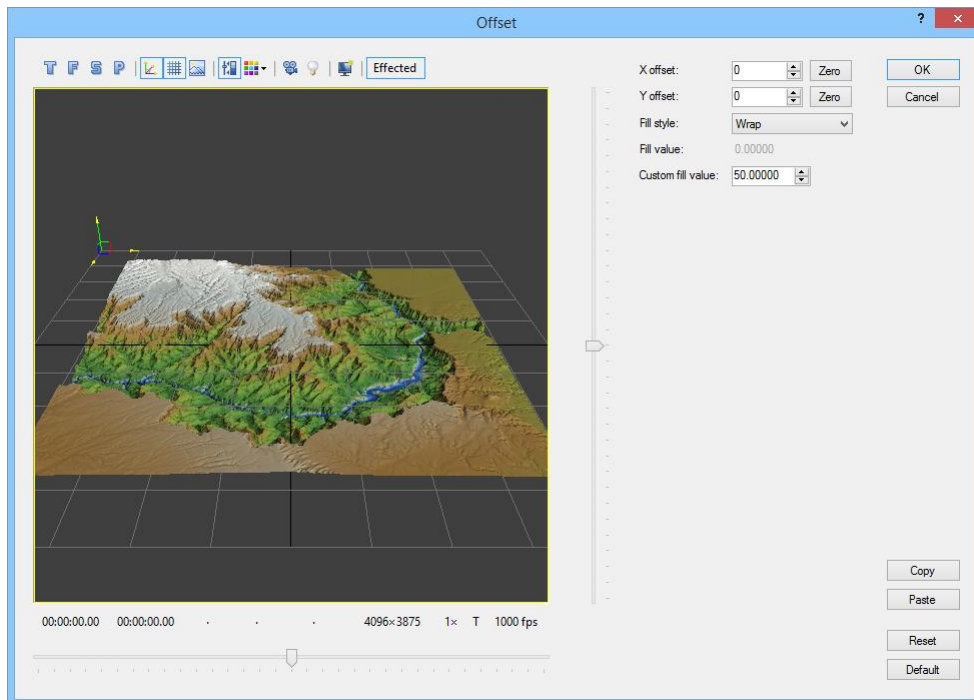
This function is typically used to create symmetrical heightmaps for specific fps game types such as capture-the-flag. The terrain for one team side can be created, and mirrored to provide proper symmetry for the second team.

This function requires 1 additional array memory allocation.

Transform: Offset

Professional Edition Only

Offsets the terrain heightmap by the specified number of units (sample, pixels or vertices).



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

X offset: The number of samples to offset on the heightmap X direction.
Y offset: The number of samples to offset on the heightmap Y direction.
Fill style: The fill style:
- Minimum = the heightmap minimum altitude.
- Center = the heightmap center altitude.
- Maximum = the heightmap maximum altitude.
- Low value = the current heightmap low altitude.
- Middle value = the current heightmap middle altitude.
- High value = the current heightmap high altitude.
- Mean (average) = the current heightmap mean altitude (average).
- Median (midpoint) = the current heightmap median altitude (midpoint).
- Mode (common) = the current heightmap mode altitude (most common).
- Custom = the altitude value specified as the Custom fill value.
- Duplicate = duplicate the value around the edge.
- Fold = fold the heightmap tiled around the edge.
- Mirror = mirror the heightmap tiled around the edge.
- Wrap = wrap the heightmap tiled around the edge.

Fill value: The fill value.
Custom fill value: The custom fill value.

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

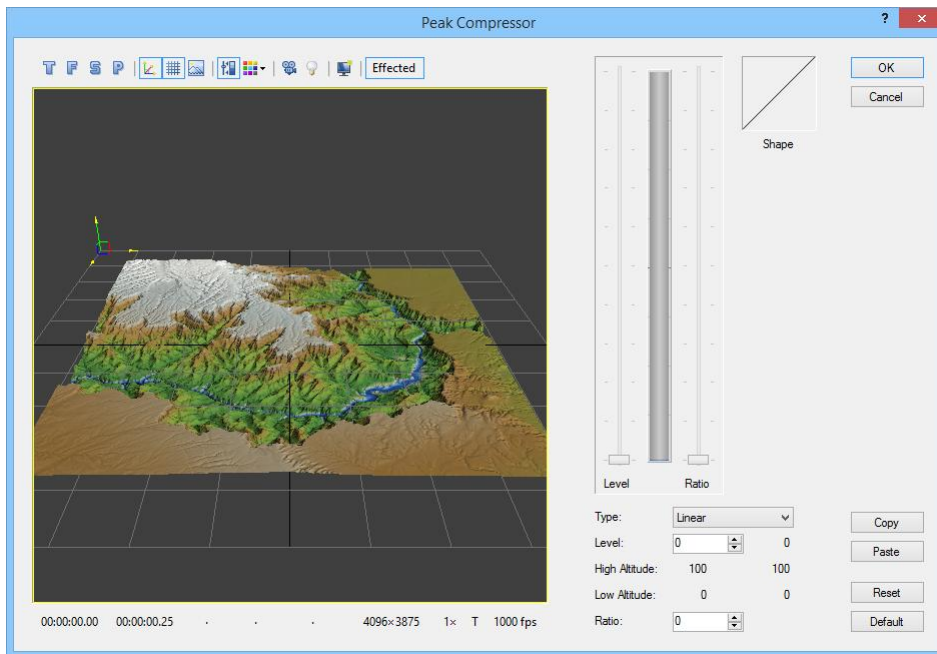
Notes

This function requires 1 additional heightmap memory allocations.

Transform: Peak Compressor

Professional Edition Only

Applies compression to the upper peak altitudes of the heightmap.



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

Type: The peak compressor type.
- Linear: the compression is linear across the level altitude and the crossover point.
- Curve 1: a C curve, the compression is curved across the altitude range.
- Curve 2: an S curve, the compression is curved across the altitude range.

Level: The positive offset altitude where the compression starts.
High Altitude: The heightmap high altitude value.
Low Altitude: The heightmap low altitude value.
Ratio: The compression ratio percent. 0 = none, 100 = full.

OK Apply the settings.
Cancel Cancel the dialog.

Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

Notes

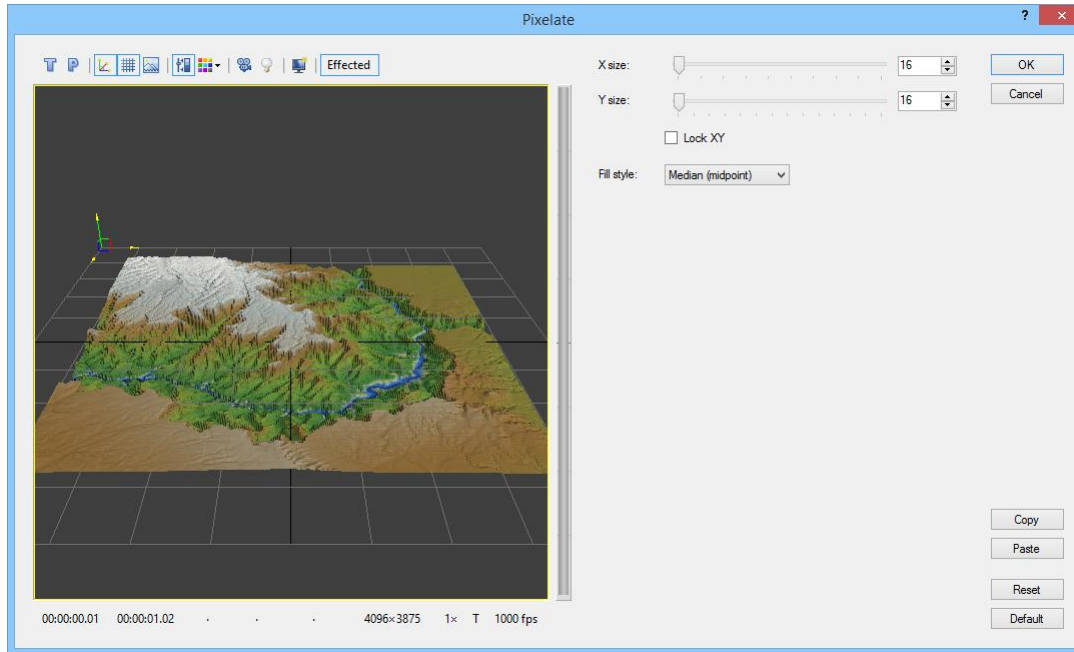
This function does not preserve the original altitude data.

The curved compression shape varies non-linearly across its range.

Transform: Pixelate

Professional Edition Only

Applies an XY axis pixelation resolution reduction to the heightmap.
The result of this transform function is more for effect or to create Minecraft like block terrain.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Altitude bar	Heightmap altitude display bar.
X size:	The heightmap X axis block size in samples.
Y size:	The heightmap Y axis block size in samples.
Lock XY:	Lock the Y value to the X value.
Fill style:	The block region fill style: <ul style="list-style-type: none">- Low value = the low altitude from the samples in the block.- Middle value = the middle altitude from the samples in the block.- High value = the high altitude from the samples in the block.- Mean (average) = the mean altitude (average) from the samples in the block.- Median (midpoint) = the median altitude (midpoint) from the samples in the block.- Mode (common) = the mode altitude (most common) from the samples in the block.
OK	Apply the settings.
Cancel	Cancel the dialog.
Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.
Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

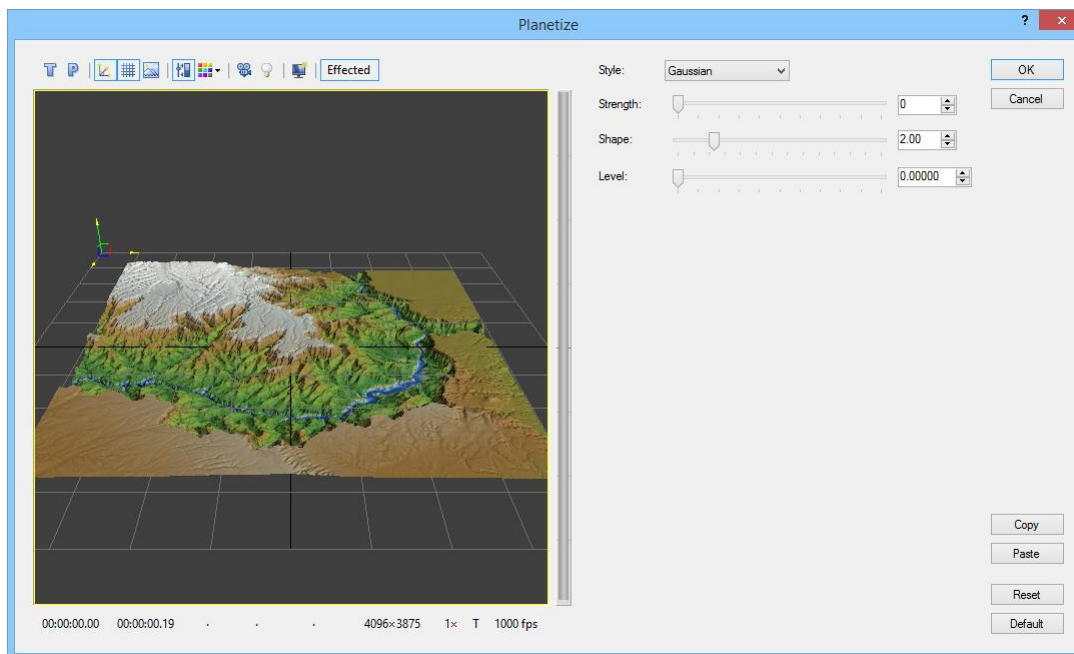
Notes

This function does not preserve the original altitude data.

Transform: Planetize

Professional Edition Only

Applies a curve to the heightmap surface to round it like a section from a planet, or inverted like a crater or bowl.



Preview toolbar	A set of toolbar buttons for preview options.
Preview	Provides a thumbnail preview of the altitude settings.
Preview statusbar	Preview information status.
Altitude bar	Heightmap altitude display bar.

Style:	The curve style: <ul style="list-style-type: none">- Gaussian = a gaussian curve.- Radial = a radial curve.- Gaussian inverted = an inverted gaussian curve.- Radial inverted = an inverted radial curve.
--------	--

Strength:	The curve strength.
Shape:	The curve shape.
Level:	The base terrain altitude level.

OK	Apply the settings.
Cancel	Cancel the dialog.

Copy	Copy the dialog properties to the system clipboard.
Paste	Paste the dialog properties from the system clipboard.

Reset	Reset the dialog controls to their initial values.
Default	Set the dialog controls to their default values.

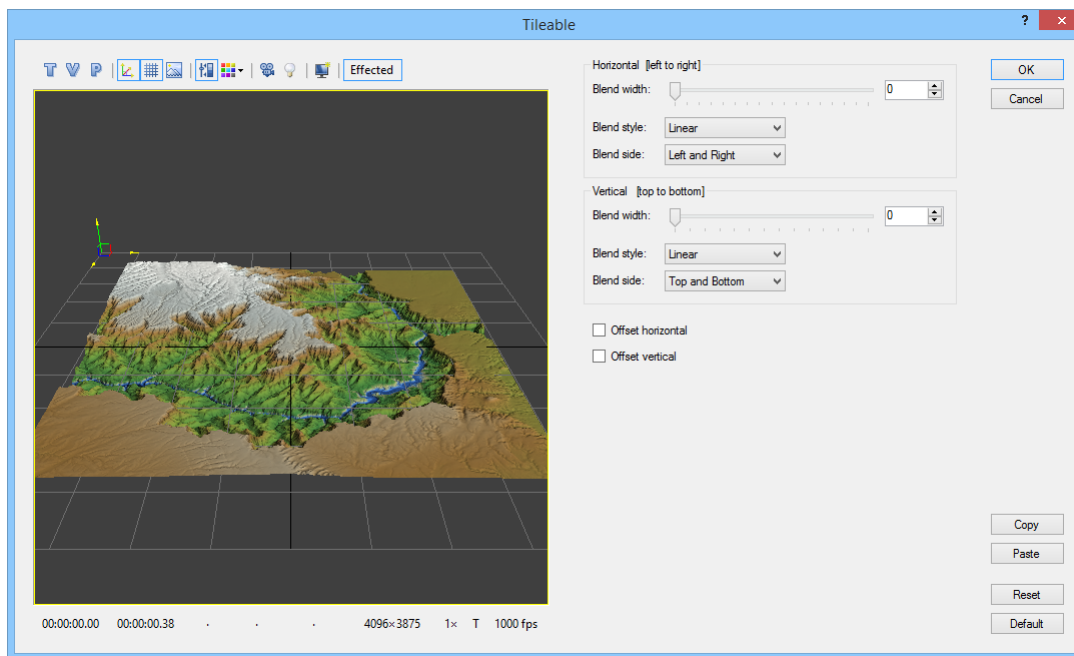
Notes

This function does not preserve the original altitude data.

Transform: Tileable

Professional Edition Only

Modify the edges of a heightmap so that it becomes tileable.



Preview toolbar A set of toolbar buttons for preview options.
Preview Provides a thumbnail preview of the altitude settings.
Preview statusbar Preview information status.

Blend width: The number of samples to use along the axis for blending the edges.
Blend style: The blend style:
- Linear = a linear ramp blend.
- Curved = a curved ramp blend.
Blend side: Whether to blend the left, right, top, or bottom sides.
Offset horizontal
Offset vertical

OK Apply the settings.
Cancel Cancel the dialog.

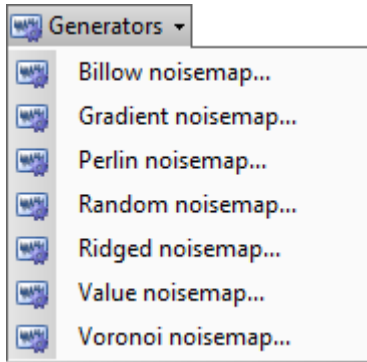
Copy Copy the dialog properties to the system clipboard.
Paste Paste the dialog properties from the system clipboard.

Reset Reset the dialog controls to their initial values.
Default Set the dialog controls to their default values.

Notes

This function does not preserve the original altitude data.


Generators



The noisemap generator objects provide a wide variety of gradient and random noise patterns in both 2D and 3D fields. The typical uses for the noisemap generator objects are to create basic heightmap designs that can be modified with other tools, and to create random detailing effects that can be added to other heightmaps. The noisemap generator objects can be used in immediate mode and on the terrain stack.





Each noisemap generator dialog provides a centralized area for controlling all of the noisemap parameters. The dialog includes a large 2D/3D preview window, a toolbar and information status bars, and a set of sliders and numeric controls to set the current noise type layout.

Most of the noisemap generators create Perlin-style procedurally generated noise, combining multiple octaves, or frequencies, of that noise to generate pseudo-realistic terrain heightmaps.

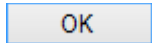
 Some of the noisemap generation algorithms do not use fully stabilized noise in order to provide a wider range of noise effects. This can sometimes result in noise spikes or other irregularities with specific combinations of property settings.

Dialog Context Help

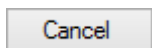
The noisemap generator dialog includes instant context-sensitive help for every dialog control. To access the context help, click on the help button on the dialog window title bar, then move the help cursor over to the control you wish to get help for, and click again. A context help tooltip will temporarily pop up. Click anywhere on the screen to remove the help tooltip.

1. Click on this button:  or  or 
2. Move the help cursor over a control and click: 

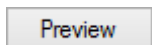
Dialog Command Buttons



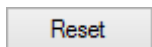
Accept the current settings and close the dialog.



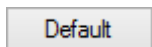
Cancel and close the dialog.



Refresh the preview window. Also see the real-time preview toolbar button.





Reset the dialog controls to their original settings when the dialog was initially opened. For immediate mode this results in the same action as the Default button. For terrain stack mode this resets the dialog to the settings that are currently on the stack.





Set the dialog controls to their default settings.


Dialog Toolbar


 **Real-time preview** – Toggle real-time preview mode.
When enabled the preview will refresh without having to choose the Preview button.


 **Top view** – Change the preview to 2D top view mode.

 **Perspective view** – Change the preview to 3D perspective view mode.


 **Show axis icon** – Toggle the preview 3D scene axis icon.


 **Show grid** – Toggle the preview 3D scene home grid.


 **Show water plane** – Toggle the preview 3D scene water plane.

 **Auto-ranging colorset** – Toggle the preview auto-range colorset mode.

 **Colorset** – Choose the preview heightmap altitude colorset.

 **Reset camera** – Reset the preview 3D scene camera location to default.



 **Reset lights** – Reset the preview 3D scene directional light position to default.

 **Screenshot** – Save a screenshot of the current preview viewport.

Preview Window Control



The preview window includes interactive viewing controls for each view mode.


2D Top View:


 +  Pan the heightmap in the preview window in 100% 1:1 Pan View.

3D Perspective View:

 +  Camera orbit.

 +  Camera pitch.

 Camera dolly.

 Cycle through camera dolly speeds.

 +  Directional Light orbit.

 +  Directional Light pitch.

Status bars

Preview build time – The time in hours:minutes:seconds.milliseconds to build the preview noisemap.

Estimated build time – The estimated time in hours:minutes:seconds.milliseconds to build the full noisemap.

X coordinate – 2D Top view heightmap X coordinate located under the mouse cursor.

Y coordinate – 2D Top view heightmap Y coordinate located under the mouse cursor.

XY Value – 2D Top view heightmap altitude value at the XY coordinates.

Source heightmap size – The source heightmap dimensions.
This is not the preview dimensions, which are set in the options.










Mouse wheel speed – the mouse wheel speed.

View mode – the preview window view mode.

Preview render performance – 3D scene frames per second.

Generator Common Properties

Noise Parameters Toolstrip

-  **Randomize** – Randomize the noisemap parameters.
This may generate a set of random numbers that creates unusable terrain.
-  **Hold** – Hold current parameters, save them to the swap buffer.
-  **Swap** – Swap the current parameters with the previous saved parameters.
-  **Open** – Open a noisemap parameters files.
-  **Save** – Save the noisemap parameters to a file.
-  **Copy** – Copy the noisemap parameters to the system clipboard.
-  **Paste** – Paste the noisemap parameters from the system clipboard.
-  **Reset** – Reset the noisemap parameters to the initial values.
-  **Defaults** – Set the noisemap parameters to the default values.

Noise Parameters Presets

Presets: Select the preset noisemap from the drop-down list.

Generator

- Offset X: The noisefield offset along the local X axis.
- Offset Y: The noisefield offset along the local Y axis.
- x10 The noisefield offset X/Y values increment by 10's.
- Zero Zero (0) the noisefield offset X/Y values.
- Seed: The noise seed number. Different number generate different noisefields.
- Randomize Randomly generate a seed number.
- Re-seed each detail level Re-seed the noise generator on each successive detail level.
- Type: The noisefield generator type. Not all generators include this property.

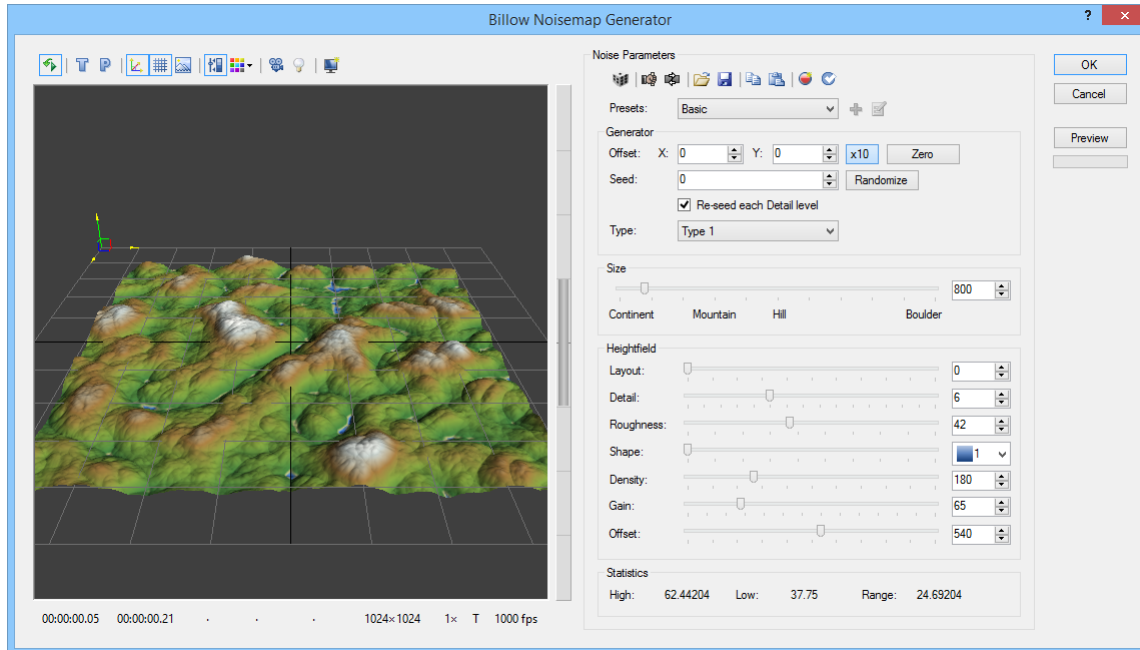
Size

The Size slider and numeric control specify the size of the noisefield geological structures.

Statistics

- High: The noisefield high value.
- Low: The noisefield low value.
- Range: The noisefield value range.

Generators: Billow noisemap



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

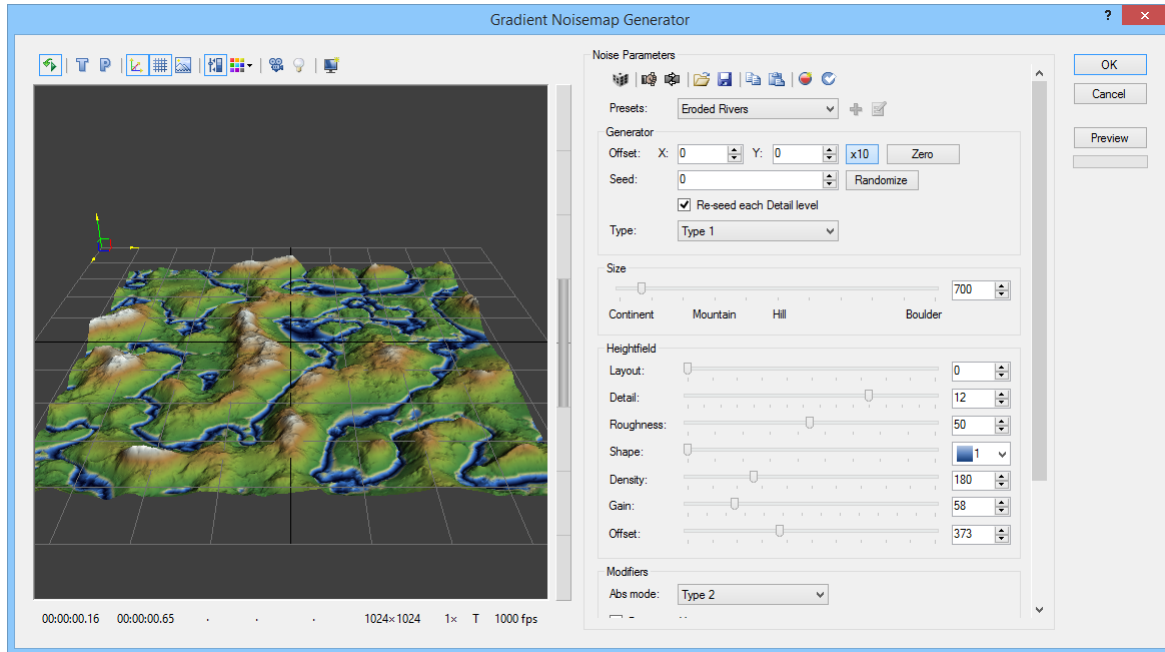
Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Generators: Gradient noisemap



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Modifiers

Abs mode: The mathematical Absolute value algorithm.

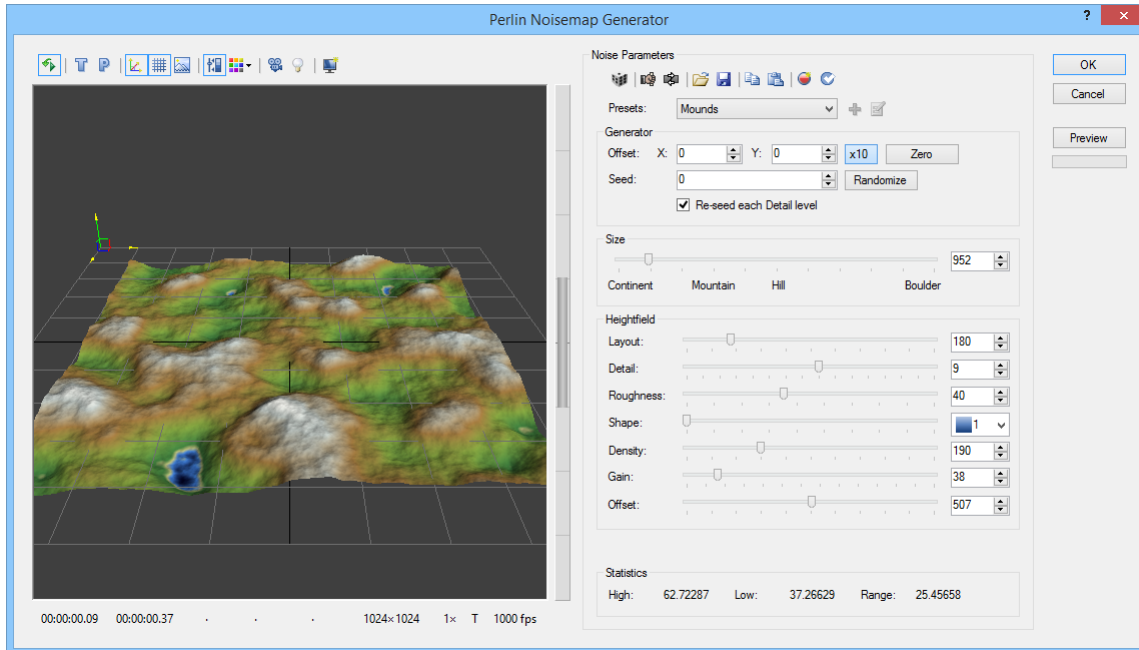
Derivative X: Use the mathematical derivative X.

Derivative Y: Use the mathematical derivative Y.

Dampen: future.

Displace: future.

Generators: Perlin noisemap



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

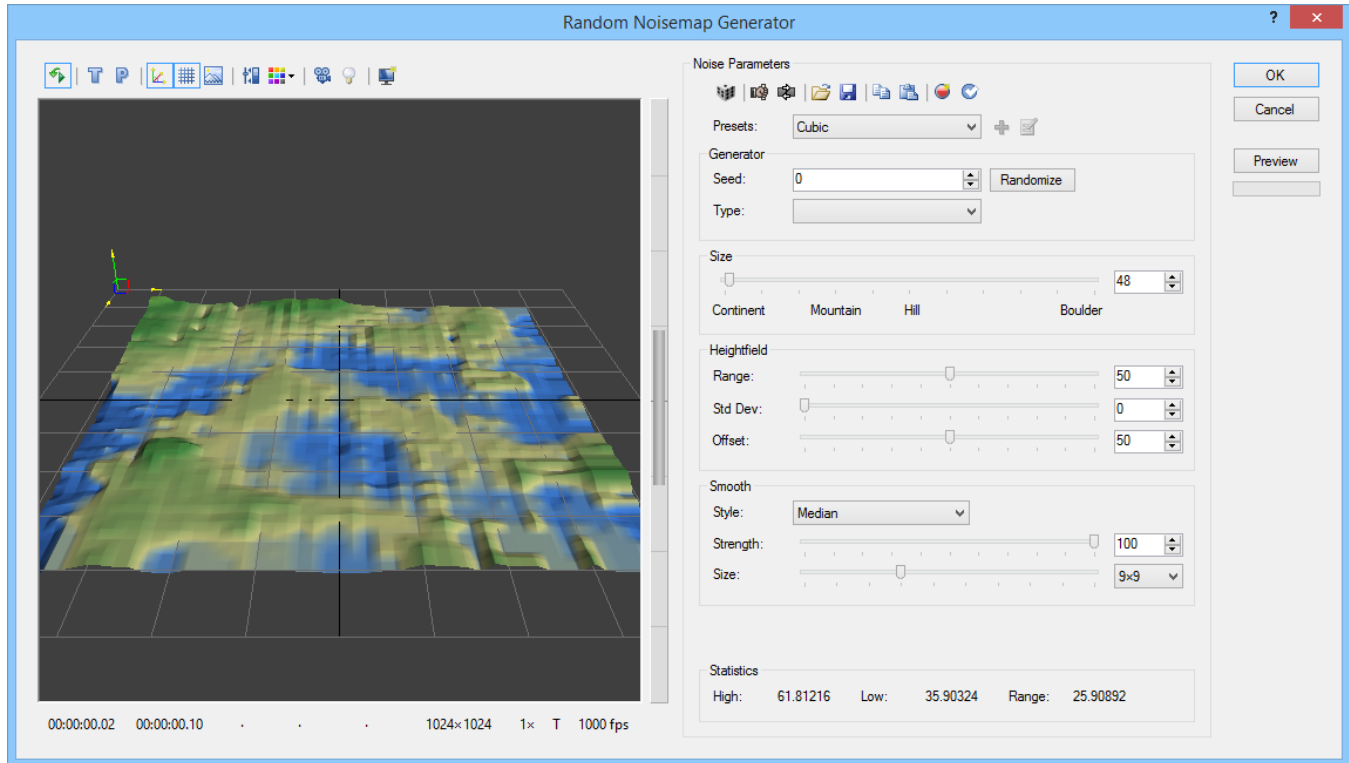
Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Generators: Random noisemap



Heightfield

Range: . The random noise overall amplitude range.

Standard Deviation: The random noise standard deviation, the amount of variability.

Offset: The noisefield 3D Y value offset.

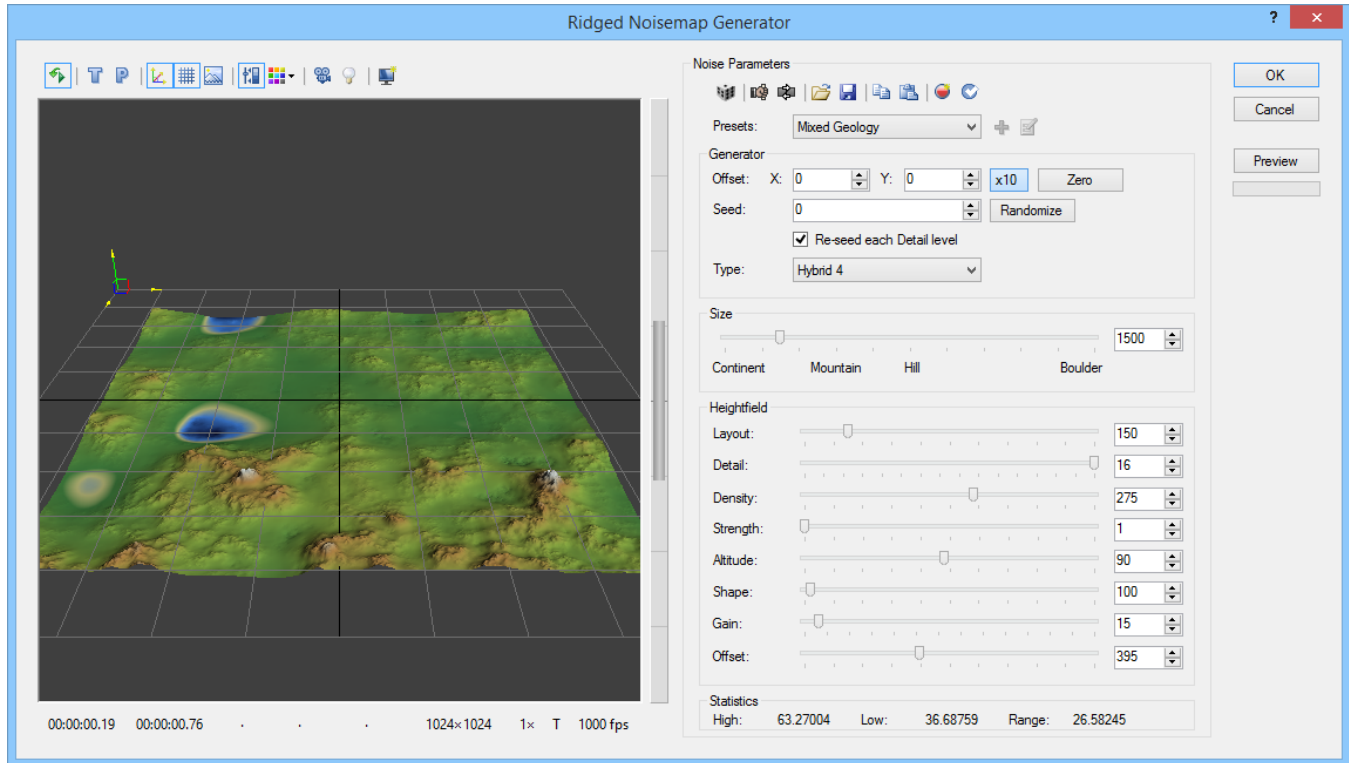
Smooth

Style: The smooth style.

Strength: The smooth strength.

Size: The smooth kernel size.

Generators: Ridged noisemap



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Density: The density of the noisefield detail.

Strength: The ridge strength.

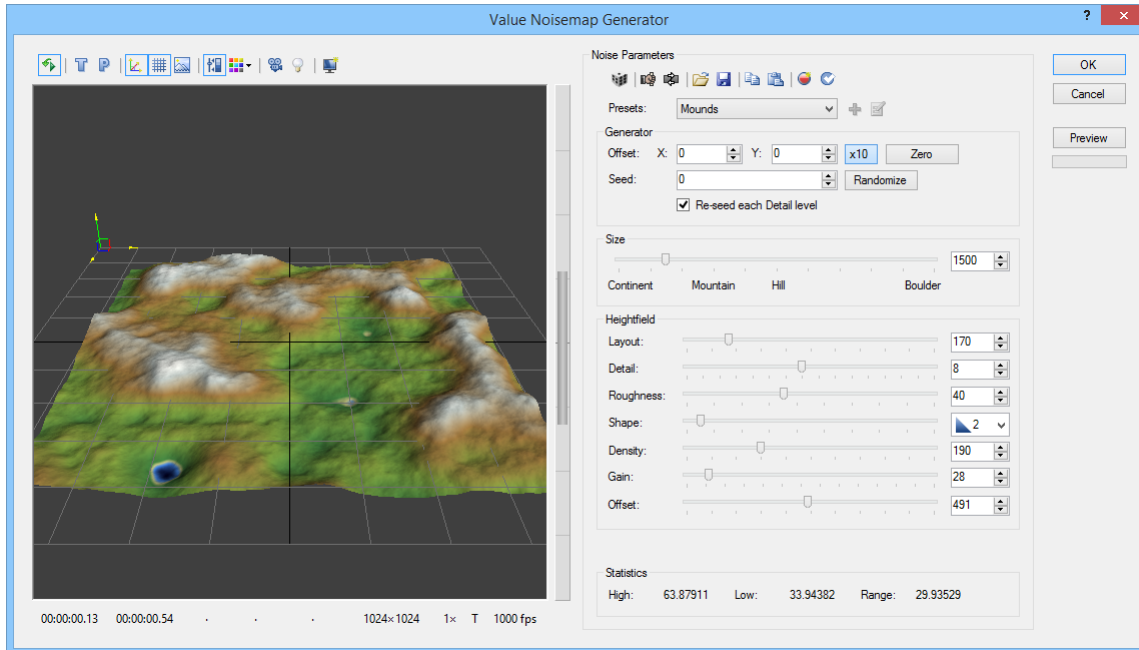
Altitude: The ridge altitude.

Shape: The ridge shape.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Generators: Value noisemap



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

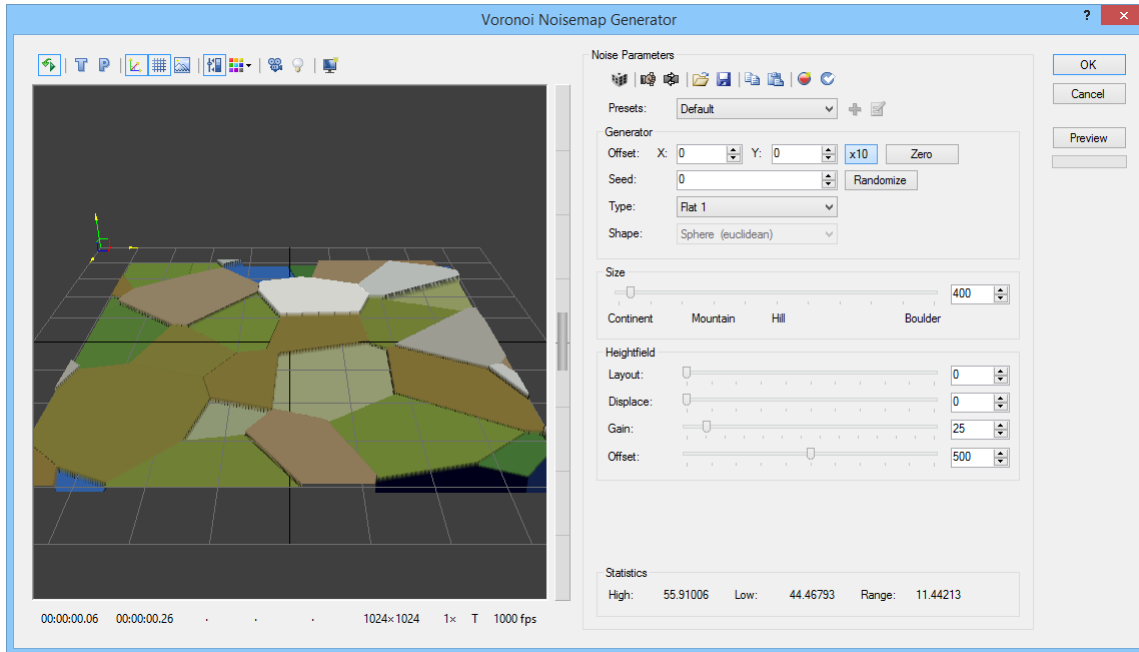
Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Generators: Voronoi noisemap



Generator

Shape: The voronoi cell shape.

Heightfield

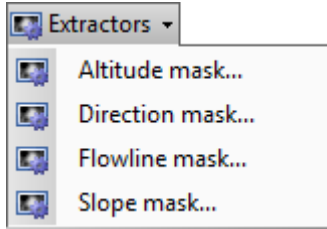
Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Displace: The voronoi cell feature displacement.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Extractors



The mask extractor objects provides a variety of algorithms for extracting weightmap mask data from heightmaps. The weightmap masks are typically used in video game engines for terrain layer systems and splatmaps and foliage mesh scattering.

Typical weightmap mask use for terrain textures or material shaders includes:

- Altitude, high: for mountain snow caps.
- Altitude, low: for oceans or lakes.
- Slope, shallow: for grasslands, for grass mesh scattering.
- Slope, steep: for cliff faces.

Each mask extractor dialog provides a centralized area for controlling all of the weightmap mask parameters. The dialog includes a large 2D preview window, a toolbar and information status bars, and multiple sliders and numeric controls to modify the weightmap mask properties.





Each weightmap mask type also includes parameters for smoothing the mask.

File parameters are available for either immediate mode saving of the weightmap mask file to disk, or for specifying the auto-saved weightmap mask file properties for terrain stack builds.

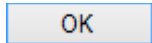
Dialog Context Help

The extractor dialog includes instant context-sensitive help for every dialog control.

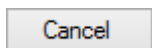
To access the context help, click on the help button on the dialog window title bar, then move the help cursor over to the control you wish to get help for, and click again. A context help tooltip will temporarily pop up. Click anywhere on the screen to remove the help tooltip.

1. Click on this button:  or  or 
2. Move the help cursor over a control and click: 

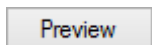
Dialog Command Buttons



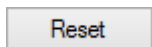
Accept the current settings and close the dialog.



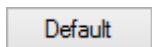
Cancel and close the dialog.



Refresh the preview window. Also see the real-time preview toolbar button.



Reset the dialog controls to their original settings when the dialog was initially opened. For immediate mode this results in the same action as the Default button. For terrain stack mode this resets the dialog to the settings that are currently on the stack.



Set the dialog controls to their default settings.

Dialog Toolbar



Real-time preview – Toggle real-time preview mode.

When enabled the preview will refresh without having to choose the Preview button.



View datamap – View the mask overlaid on the heightmap.



View mask – View the mask overlaid on the heightmap.



View overlay – View the mask overlaid on the heightmap.



Zoom to fit – View zoom-to-fit size.



Zoom 100% – View zoom 1:1 100% size.




Reset pan to center – Reset 1:1 panning to image center.



Reset pan to origin – Reset 1:1 panning to image top-left.



Pointer mode – Pointer mode.

 **Pan mode** – 1:1 Pan mode.

Preview Window Control

The preview window includes interactive viewing controls for the 1:1 view mode.



Pan the heightmap in the preview window in 100% 1:1 Pan View.

Statusbar

Preview build time – The time in milliseconds to build the preview weightmap mask.

X coordinate – The weightmap mask X coordinate located under the mouse cursor.

Y coordinate – The weightmap mask Y coordinate located under the mouse cursor.

Datamap XY value – The datamap altitude value at the XY coordinates.

Mask XY value – The weightmap mask altitude value at the XY coordinates.

Datamap size – The source heightmap dimensions.

Extractor Common Properties

Smooth

Bypass Bypass the smooth function.

Size: Specify the smooth kernel size:

Strength: Specify the smooth strength.

File output

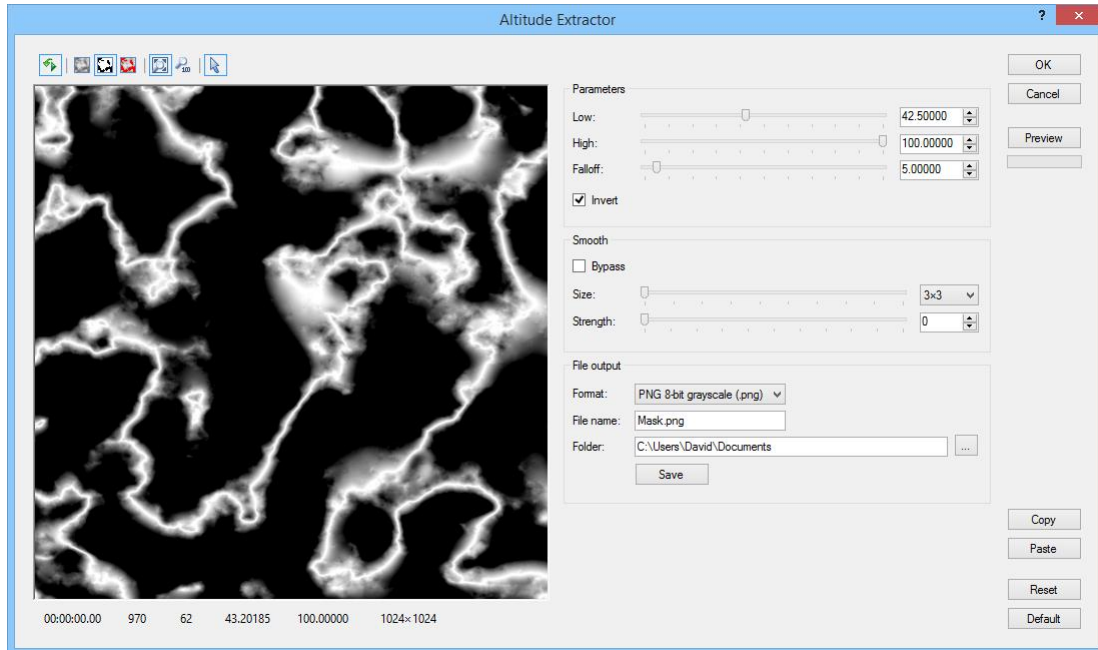
Format: Choose the weightmap mask file output file format.

File name: Specify the weightmap mask file output name.

Folder: Choose the weightmap mask file output folder.

Save Save the weightmap mask file to disk.

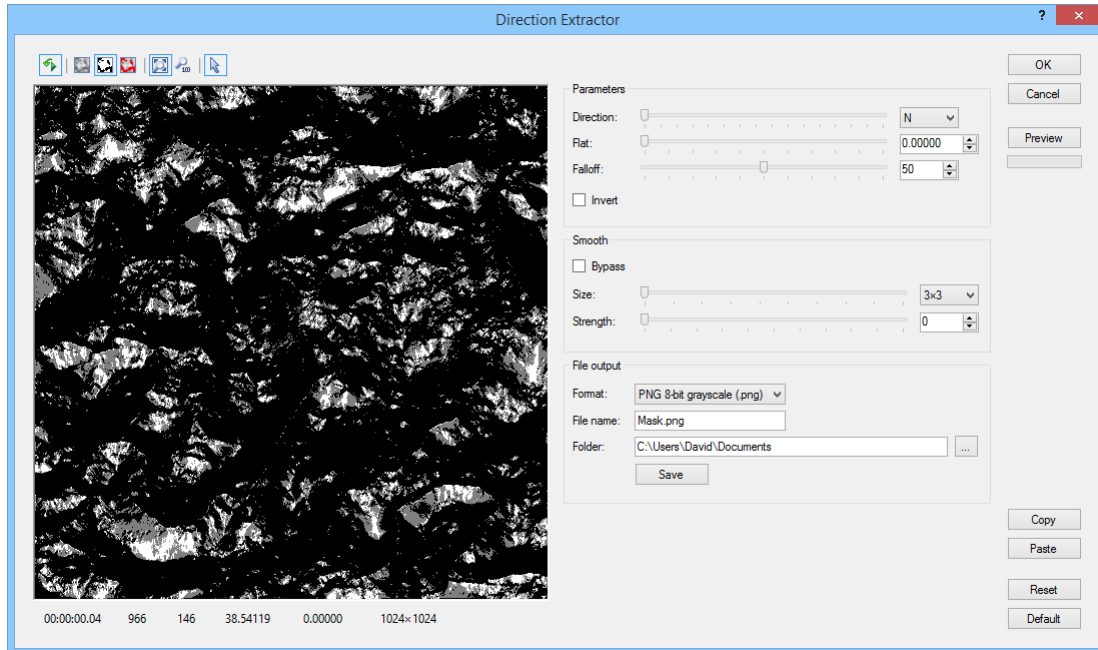
Extractor: Altitude



Parameters

- Low: The low altitude value.
- High: The high altitude value.
- Falloff: The altitude falloff value.
- Invert: Invert the mask.

Extractor: Direction



Parameters

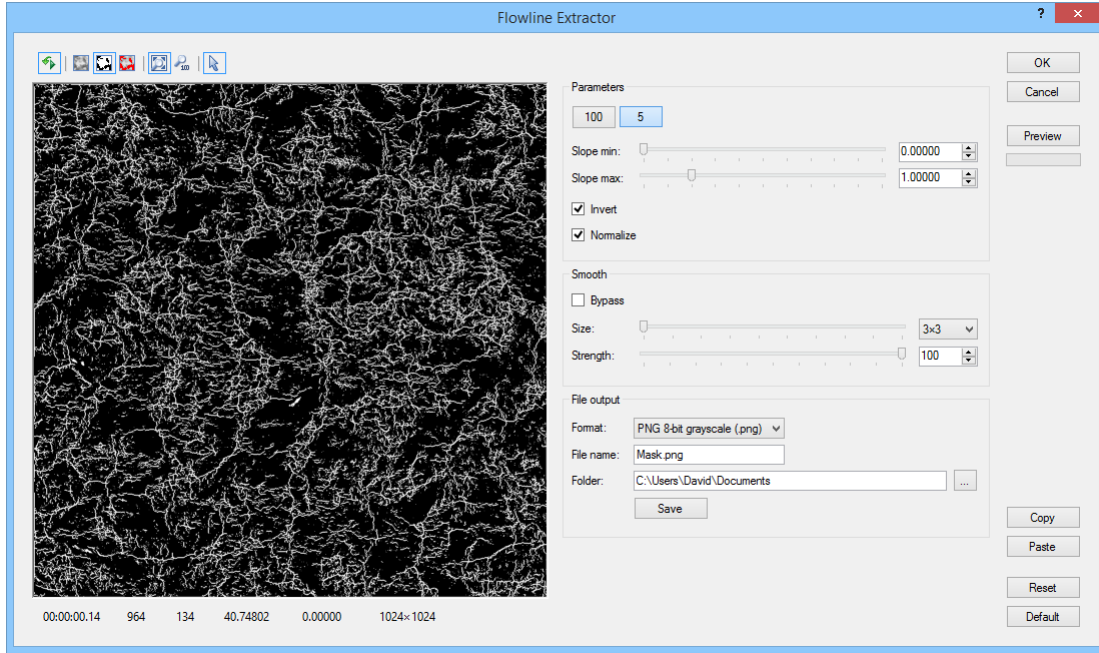
Direction: Mask the terrain sides that are facing the specified compass direction.

Flat: Exclude the flatter regions.

Falloff: The direction falloff value.

Invert Invert the mask.

Extractor: Flowline



Parameters

100 / 5 Set the slope controls to a range of 100 or 5.

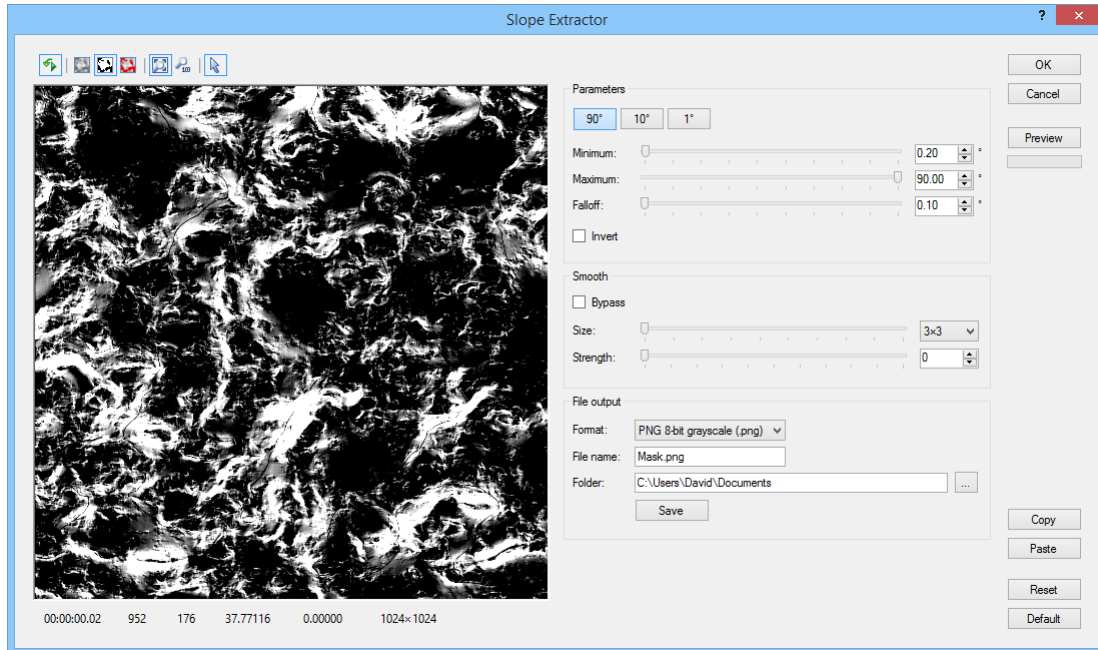
Slope minimum: The slope minimum value.

Slope maximum: The slope maximum value.

Invert Invert the mask.

Normalize Normalize the mask.

Extractor: Slope



Parameters

90 / 10 / 1 Set the controls to a range of 90, 10, or 1 degree.

Minimum: The minimum slope angle value.

Maximum: The maximum slope angle value.

Falloff: The slope angle falloff value.

Invert Invert the mask.

Statistics

The Statistics dialog displays a set of statistical values for the current base heightmap, along with a variety of statistical graphing functions.

The statistical values list contains in-depth information on the current base heightmap.

The available graph types include Altitude, Deviation, Histogram, and Range.

Each graph is based on a horizontal altitude from 0.0 to 100.0 with the gradient bar indicator referencing 0.0 as black and 100.0 as white.

Altitude Statistics

This graph displays the heightmap altitude values of high, low, mean, median, and mode.

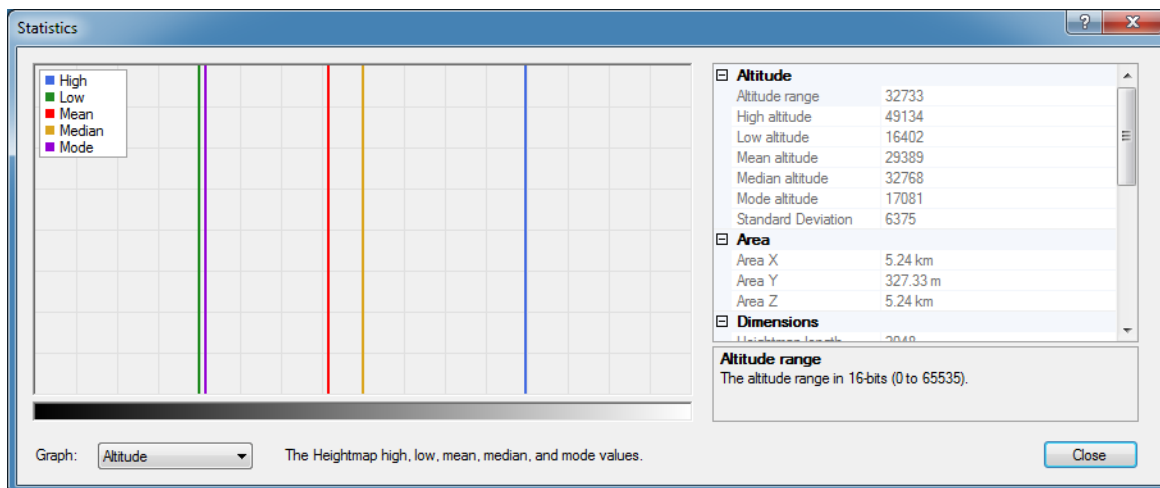
High: the highest altitude.

Low: the lowest altitude.

Mean: the mean altitude, the mathematical average value.

Median: the median altitude, the midpoint value.

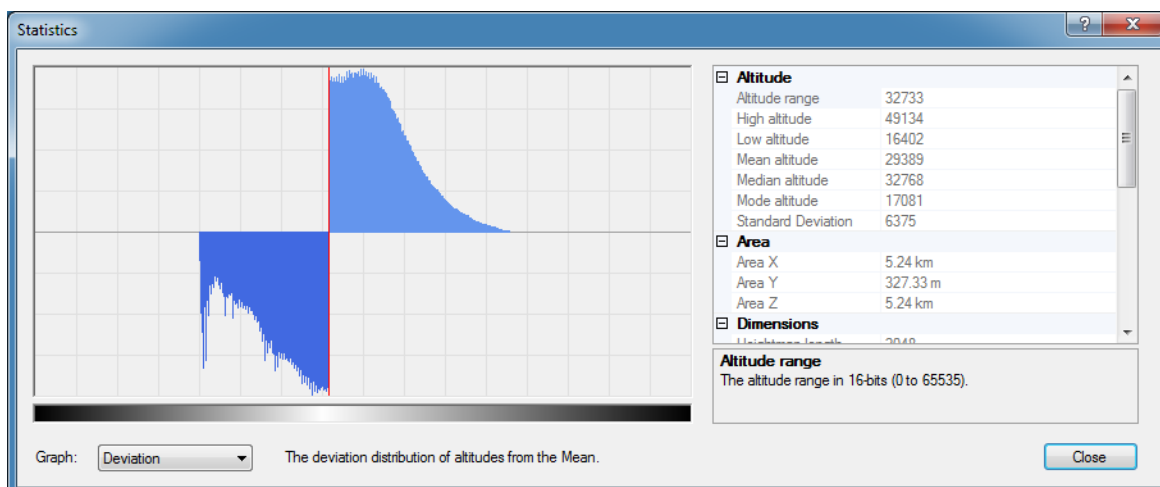
Mode: the mode altitude, the most frequently occurring value.



Deviation Statistics

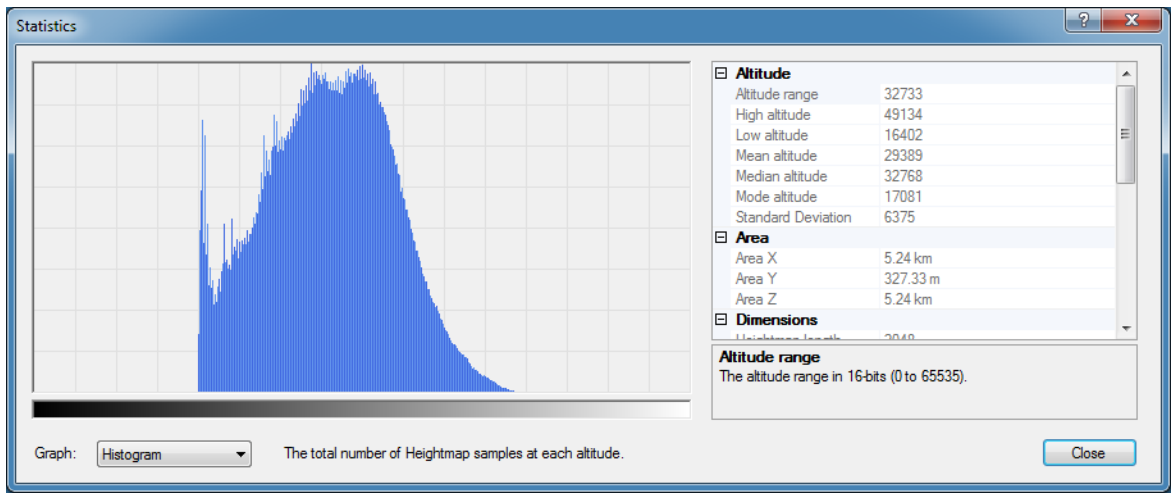
This graph displays a deviation curve of the heightmap data.

The statistical deviation is the distribution of all of the heightmap altitudes, positive and negative, from the Mean mathematical average value.



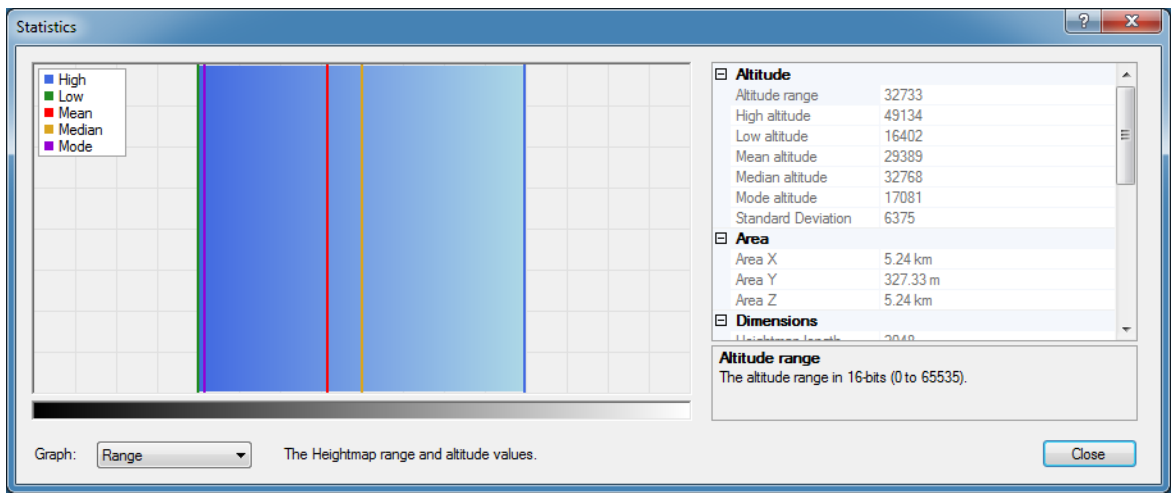
Histogram Statistics

This graph displays a histogram curve of the heightmap data. The histogram is the frequency distribution of the data, which is a total count of each individual altitude.



Range Statistics

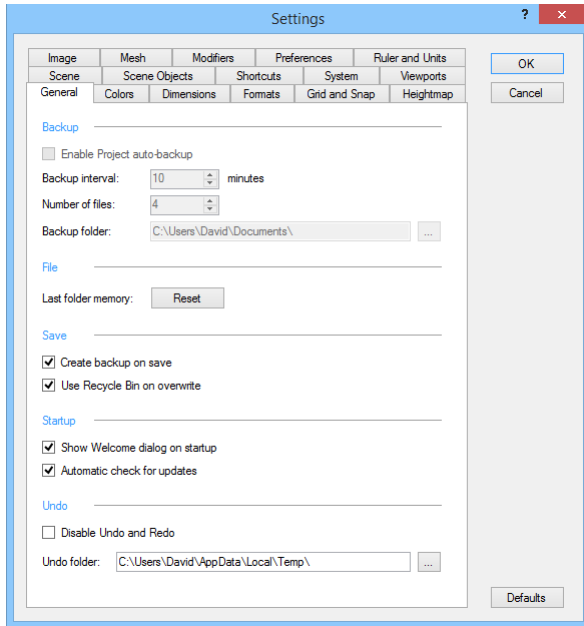
This graph is similar to the Altitude graph but includes a gradient region that depicts the full range of the heightmap data.



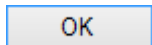
Settings

The application settings are available on a multi-tabbed dialog that is launched from the Editor's Tools menu. The settings allow the end-user to specify the default settings and values for a number of the application functions.

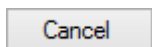
The application ini file that contains the application startup defaults can also be set back to its original "new" state and contents by clicking on the *Defaults* button and restarting the application.



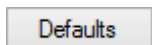
Command Buttons



Accept the current settings and close the dialog.



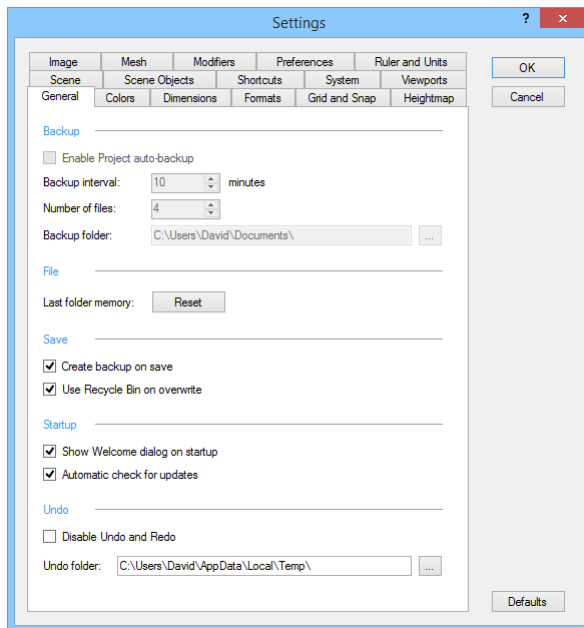
Cancel and close the dialog.



Set all application ini settings to the default values. This requires an application restart.

Settings: General

This tab contains the application general settings.



Backup

- Enable Project auto-backup:** Enable or disable the auto backup feature.
- Backup interval:** The time in minutes between backup file creation.
- Number of files:** The number of backup files to maintain, older files are deleted.
- Backup folder:** The folder where the backup files are saved. Default is the Documents folder.

File

- Last folder memory:** Resets all of the last folder memories to their default system folder locations. See the *Last Folder Memory* chapter.

Save

- Create backup on save:** Whether to create a backup file when saving will result in a file overwrite.
- Use Recycle Bin on overwrite:** Whether to move files to the Windows Recycle bin that are being overwritten.

Startup

- Show Welcome on startup:** Whether the Welcome dialog is displayed on application startup.
- Automatic check for updates:** Whether TerreSculptor checks for software updates automatically.

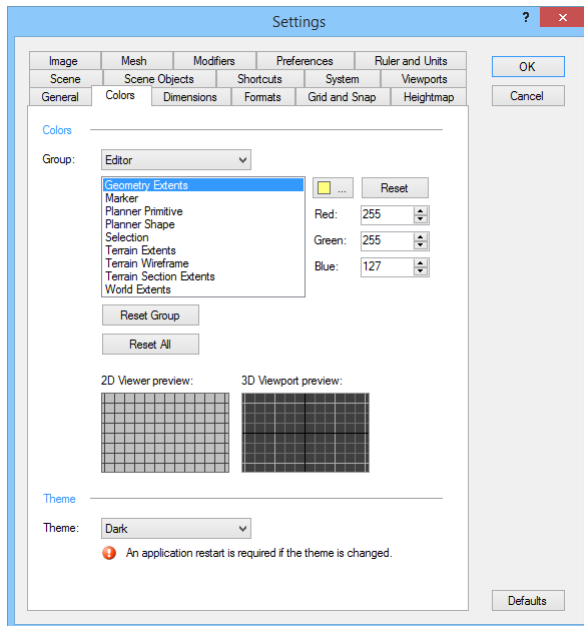
Undo

- Disable Undo and Redo:** Whether to disable the Edit menu undo system.
- Undo folder:** The system folder where the undo and redo files are temporarily saved.

Settings: Colors

This tab contains the application object colors settings.

This tab and its controls allow for customization of the colors for various application editors and objects.



Colors

- Group: The application group.
- Object list: The list of objects with the group.
- Color button: The current color of the selected object in the group.
- Red, Green, Blue: The current color red, green, and blue values for the selected object in the group.
- Reset: Reset the selected object to its default color.
- Reset Group: Reset all objects in the group to their default colors.
- Reset All: Reset all objects to their default colors.

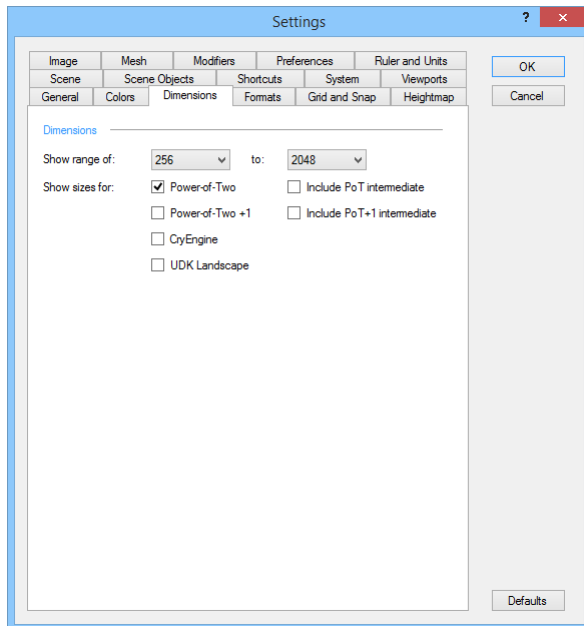
- Viewer preview: A visual graphical preview of the 2D viewer and grid coloring.
The 2D viewer colors are used on the Heightmap Converter, Mask Editor, and Sky Converter.
- Viewport preview: A visual graphical preview of the 3D viewport and grid coloring.
The 3D viewport colors are used on the Editor, Mesh Converter, and Normalmap Creator.

Theme

Choose the application color theme. Many of the application controls will change color to follow the theme.

Settings: Dimensions

This tab contains the application heightmap and mask dimensions settings. The properties specify the dimension range that is shown on certain dialogs.

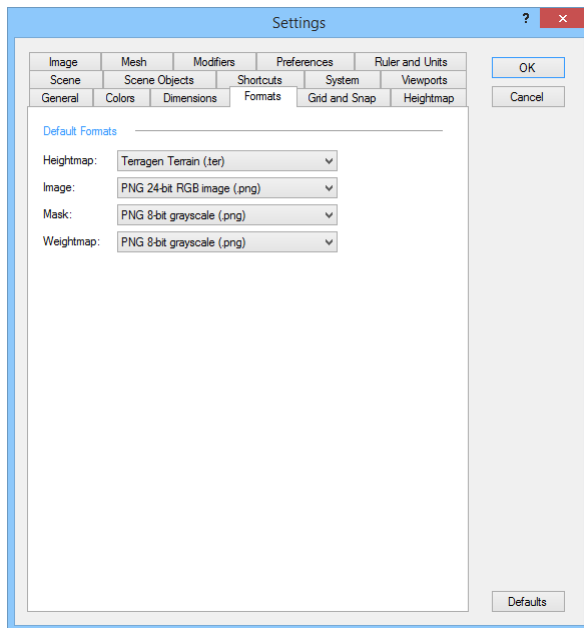


Dimensions

- Show range of:** Specify the dimension range to show on specific dialogs such as New. This allows you to specify only those values that are used in your projects.
- Power-of-Two:** Whether the New and Resample dialogs display power-of-two dimensions. Power-of-two dimensions are values that are 2^n where $n = 1, 2, 3, 4, \dots$, such as $2^8 = 256$, $2^{10} = 1024$, $2^{12} = 4096$. Power-of-two dimensions result in terrain meshes that are power-of-two -1 quads, $2^8 = 256$ dimension = 256 vertices = 255 terrain quads.
- Include PoT intermediate:** Whether to include the Power-of-two intermediate values. Intermediate values include those that are multiples of power-of-two values, such as 96, 192, 384, 768, etc., which lay typically between p-o-t value.
- Power-of-Two +1:** Whether the New and Resample dialogs display power-of-two +1 dimensions. Power-of-two +1 dimensions are values that are $2^n + 1$ where $n = 1, 2, 3, \dots$, such as $2^8 + 1 = 257$, $2^{10} + 1 = 1025$, $2^{12} + 1 = 4097$. Power-of-two +1 dimensions result in terrain meshes that are power-of-two quads, $2^8 + 1 = 257$ dimension = 257 vertices = 256 terrain quads.
- Include PoT intermediate:** Whether to include the Power-of-two + 1 intermediate values. Intermediate values include those that are multiples of power-of-two + 1 values, such as 97, 193, 385, 769, etc., which lay typically between p-o-t+1 value.
- CryEngine:** Whether the New and Resample dialogs display CryEngine dimensions.
- UDK Landscape:** Whether the New and Resample dialogs display UDK Landscape dimensions. A common set of UDK Landscape dimensions are provided, plus a UDK size dialog. See the UDK online documentation for additional dimension procedures.

Settings: Formats

This tab contains the application default file formats settings.

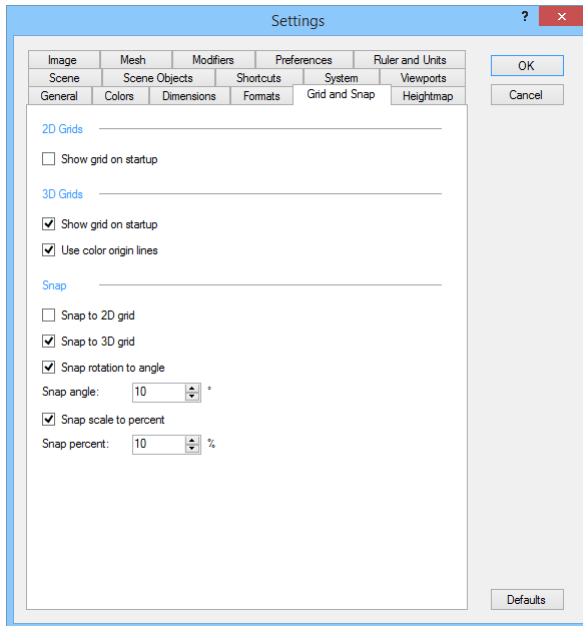


Default Formats

- Heightmap: The default heightmap file format.
- Image: The default image file format (screenshot, etc.).
- Mask: The default mask file format.
- Weightmap: The default weightmap file format.

Settings: Grid and Snap

This tab contains the application settings for the grids and object snapping.



2D Grids

Show grid on startup: Whether to show the 2D grids on application startup.

3D Grids

Show grid on startup: Whether to show the 3D grids on application startup.

Use color origin lines: Whether the 3D grid origin lines will be color-coded to their X,Y,Z axis color.

Snap

Snap to 2D grid: future feature.

Snap to 3D grid: future feature.

Snap rotation to angle: future feature.

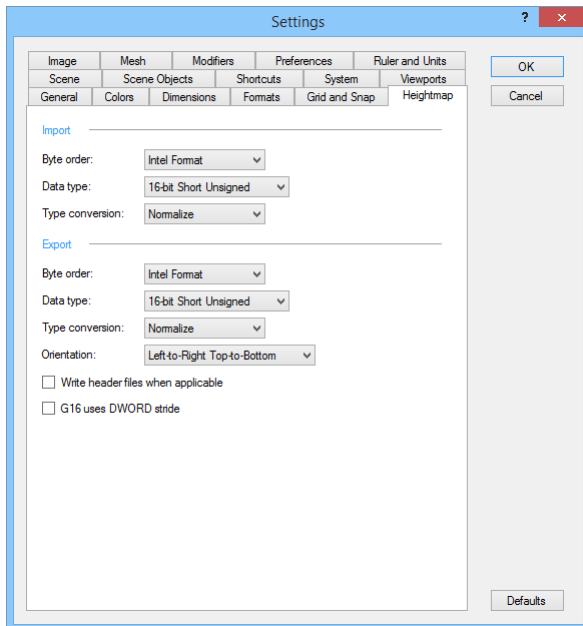
Snap angle: future feature.

Snap scale to percent: future feature.

Snap percent: future feature.

Settings: Heightmap

This tab contains the application settings for the default import and export settings for heightmap type files. The individual option usage varies by the specific file format importer/exporter.



Import

Byte order: The integer or float data byte order: Motorola (big-endian) or Intel (little-endian).
Data type: The data type: 8-bit, 16-bit, 32-bit, 64-bit, Integer and Float, Signed and Unsigned.
Type conversion: The data type conversion: Real (actual), Scaled (1.0), Auto (to fit).

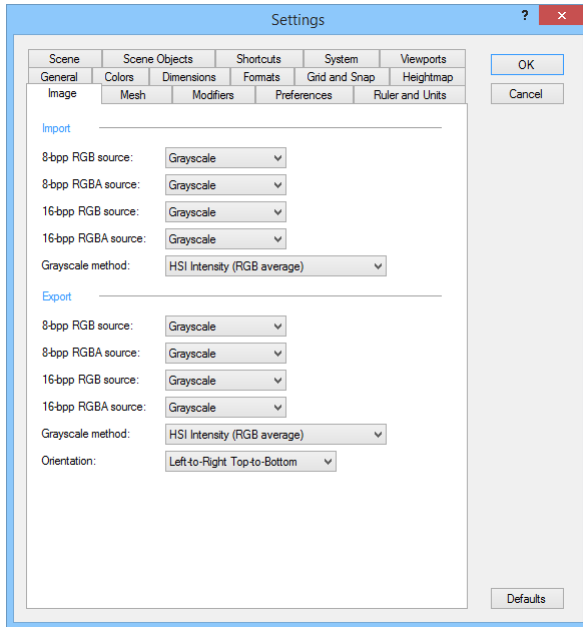
Export

Byte order: The integer or float data byte order: Motorola (big-endian) or Intel (little-endian).
Data type: The data type: 8-bit, 16-bit, 32-bit, 64-bit, Integer and Float, Signed and Unsigned.
Type conversion: The data type conversion: Real (actual), Scaled (1.0), Auto (to fit).

Orientation: The orientation of the data in the file.
Optimized 8-bit: Whether the data is automatically scaled to use the widest 8-bit range.
Write header: Whether a separate header file is written for header-less file formats.
G16 uses DWORD stride: A hack to fix the UE3 G16 file stride bug.

Settings: Image

This tab contains the application settings for the default import and export settings for image type files. The individual option usage varies by the specific file format importer/exporter.



Import

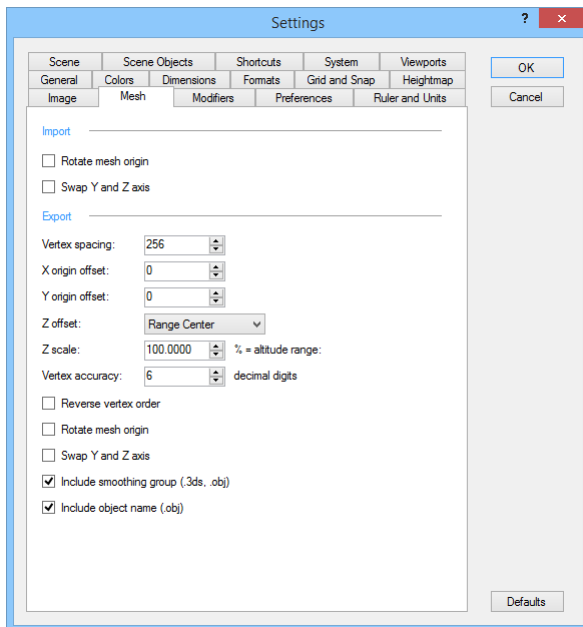
- 8-bpp RGB Source:** The color plane to use for the import source on 8-bit-per-pixel RGB files.
- 8-bpp RGBA Source:** The color plane to use for the import source on 8-bit-per-pixel RGBA files.
- 16-bpp RGB Source:** The color plane to use for the import source on 16-bit-per-pixel RGB files.
- 16-bpp RGBA Source:** The color plane to use for the import source on 16-bit-per-pixel RGBA files.
- Grayscale method:** The algorithm method to use when converting color to grayscale.

Export

- 8-bpp RGB Source:** The color plane to use for the export source on 8-bit-per-pixel RGB files.
- 8-bpp RGBA Source:** The color plane to use for the export source on 8-bit-per-pixel RGBA files.
- 16-bpp RGB Source:** The color plane to use for the export source on 16-bit-per-pixel RGB files.
- 16-bpp RGBA Source:** The color plane to use for the export source on 16-bit-per-pixel RGBA files.
- Grayscale method:** The algorithm method to use when converting color to grayscale.
- Orientation:** The orientation of the data in the file.

Settings: Mesh

This tab contains the application settings for the default import and export settings for mesh type files. The individual setting usage varies by the specific file format importer/exporter. Mesh files are typically stored as a rectangular grid-plane of constant-spaced XY coordinates with Z axis altitudes.



Import

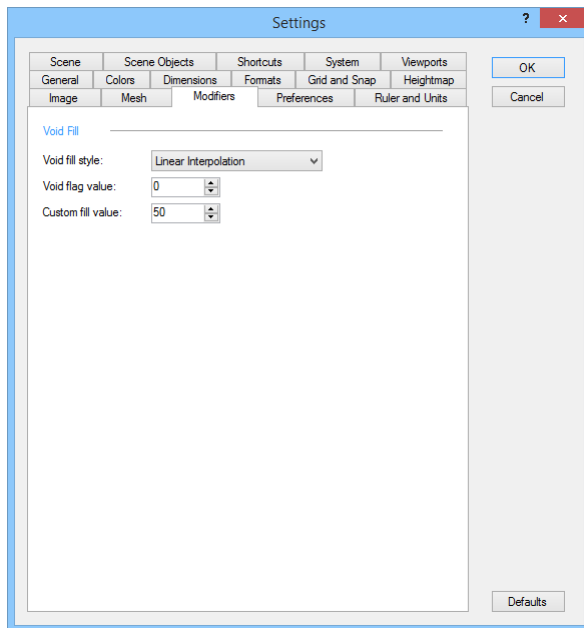
Rotate mesh origin: Whether to rotate the mesh origin by 90 degrees clockwise.
Swap Y and Z axis: Whether to swap the mesh Y and Z axis for meshes that are using Z-up coordinates.

Export

Vertex spacing: The vertex spacing multiplier.
X origin offset: The amount to offset the X origin.
Y origin offset: The amount to offset the Y origin.
Z offset: Whether to offset the mesh Z axis data.
Z scale: Whether to scale the mesh Z axis data.
Vertex accuracy: The number of digits of numerical accuracy for text-format mesh files.
Reverse vertex order: Whether the triangle vertex order is reversed to flip the face orientation.
Rotate mesh origin: Whether to rotate the mesh origin by 90 degrees clockwise.
Swap Y and Z axis: Whether to swap the mesh Y and Z axis for meshes that are using Z-up coordinates.
Include smoothing group: Whether the smoothing group properties are included in the file.
Include object name: Whether the object name property is included in the file.

Settings: Modifiers

This tab contains the application settings for the specified modifiers.

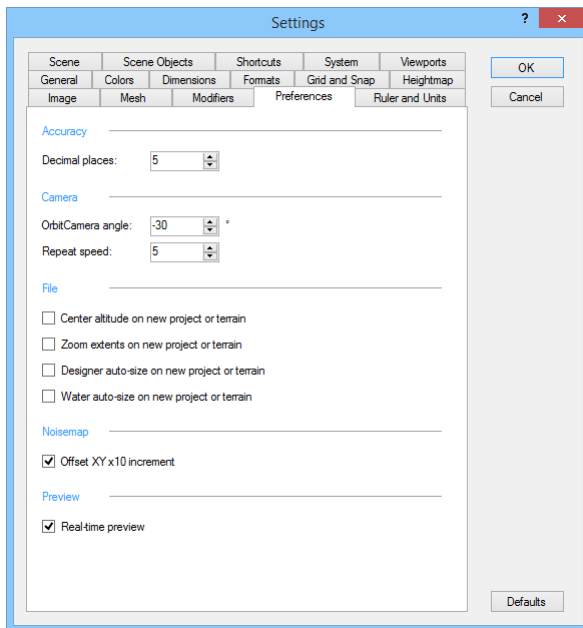


Void Fill

- Void fill style: The default style of void fill to use.
- Void flag value: The default void flag value.
- Void fill value: The void fill value for the Custom Fill Value style.

Settings: Preferences

This tab contains the application user preferences.



Accuracy

Decimal places: The number of decimal places that the numeric up-down controls will show.

Camera

OrbitCamera angle: The orbit camera navigation pad angle in degrees.

Repeat speed: The camera navigation pad repeat speed.

File

Center altitude on import: Whether imported heightmaps are moved to the centered altitude.

Zoom extents on New or Import: Whether the orbit camera zooms to extents on New or Import.

Designer auto-size on New or Import: Whether the Designer plane auto-sizes on New or Import.

Water auto-size on New or Import: Whether the Water plane auto-sizes on New or Import.

Noisemap

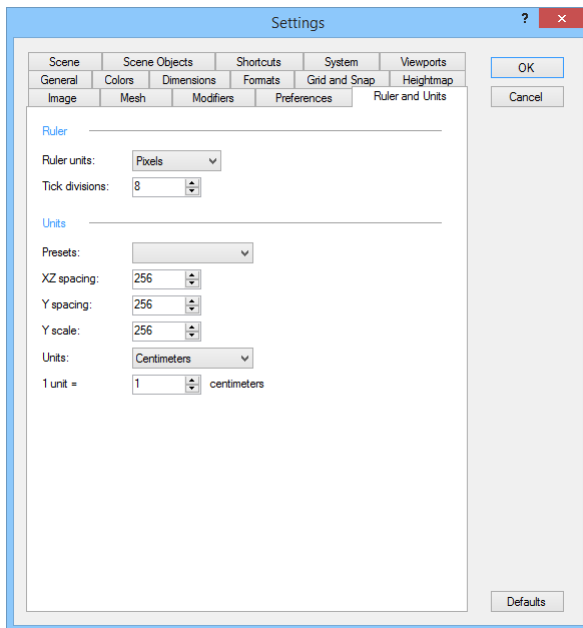
Offset XY x10 increment: Whether the Noise Generator Offset X/Y controls increment by 10 times the value.

Preview

Real-time preview: Whether the preview window updates automatically or requires user interaction. Real-time preview should be set to off for slower computers.

Settings: Ruler and Units

This tab contains the application settings for the ruler measuring system and the engine dimensioning units.



Ruler

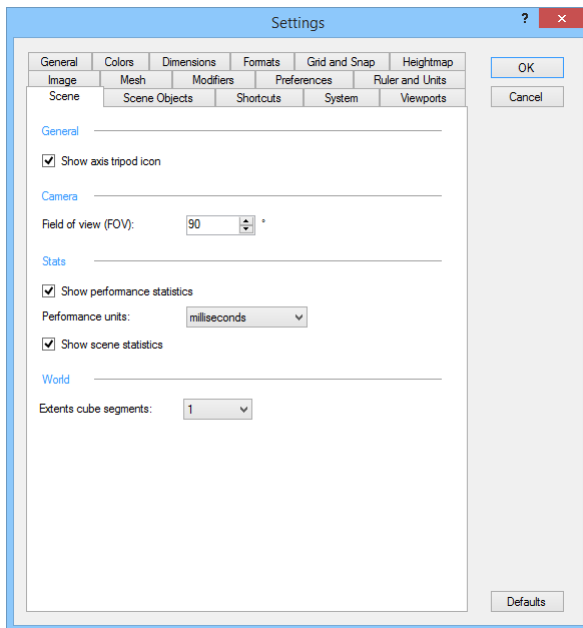
Ruler units: The Heightmap Editor ruler units.
Tick divisions: The Heightmap Editor ruler tick divisions.

Units

Presets: Units presets for common video game engine matching.
XZ spacing: The default engine spacing on the XZ axes.
Y spacing: The default engine spacing on the Y axis.
Y scale: The default Y axis scaling so that an equal XYZ value set creates a cubic area.
Units: The engine dimensioning base unit type.
1 unit = : The engine dimensioning unit.

Settings: Scene

This tab contains the application settings for the Editor scene.



General

Show axis tripod icon: Whether the XYZ axis icon is displayed in the viewport lower-left corner.

Camera

Field of view (FOV): Determines the Editor viewport camera FOV (field of view). The range is 60 to 120 degrees. The default is 90 degrees. Smaller values are narrow-angle lenses. Larger values are wide-angle lenses.

Stats

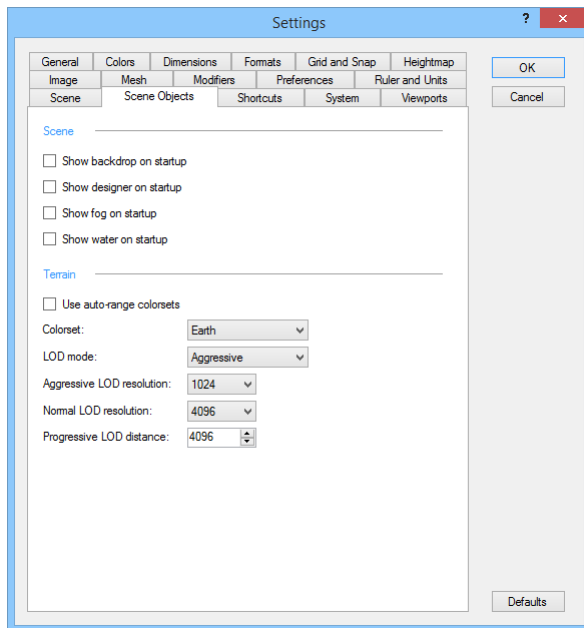
Show performance statistics: Whether the render engine performance statistics are shown on the viewport.
Performance unit: The performance statistics units.
Show scene statistics: Whether the render engine scene statistics are shown on the viewport.

World

Extents cube segments: The number of wireframe segments in the world extents cube.

Settings: Scene Objects

This tab contains the application options for the Editor scene objects.



Scene

Show backdrop on startup:

Whether the backdrop is shown on application startup.

Show designer on startup:

Whether the designer plane is shown on application startup.

Show fog on startup:

Whether the fog is shown on application startup.

Show water on startup:

Whether the water plane is shown on application startup.

Terrain

Use auto-range colorsets:

Whether to use auto-range colorsets by default.

Colorset:

The terrain mesh default colorset.

LOD mode:

The default terrain level of detail mode.

Aggressive LOD resolution:

The maximum dimensions of the terrain in aggressive lod mode.

Normal LOD resolution:

The maximum dimensions of the terrain in normal lod mode.

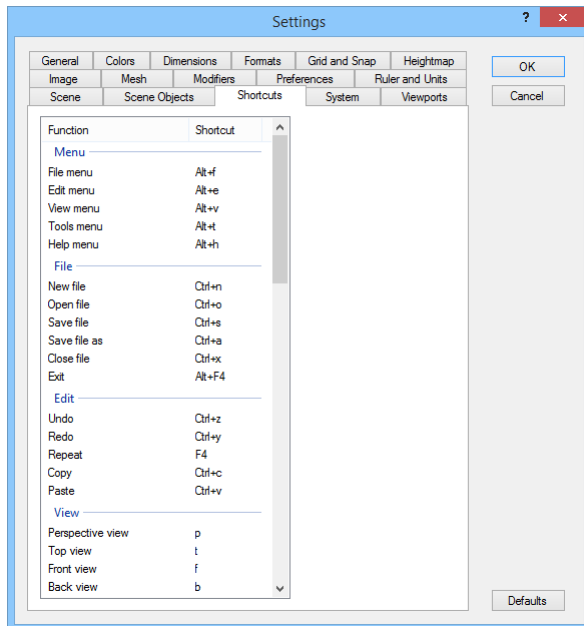
Progressive LOD distance:

future feature.

Settings: Shortcuts

This tab contains the application shortcut accelerator keys information.

The combination keys include lowercase and uppercase letter versions which determine whether the Shift key is pressed. eg. Ctrl+b = press the Ctrl key and B key, Ctrl+B = press the Ctrl key and Shift key and B key.

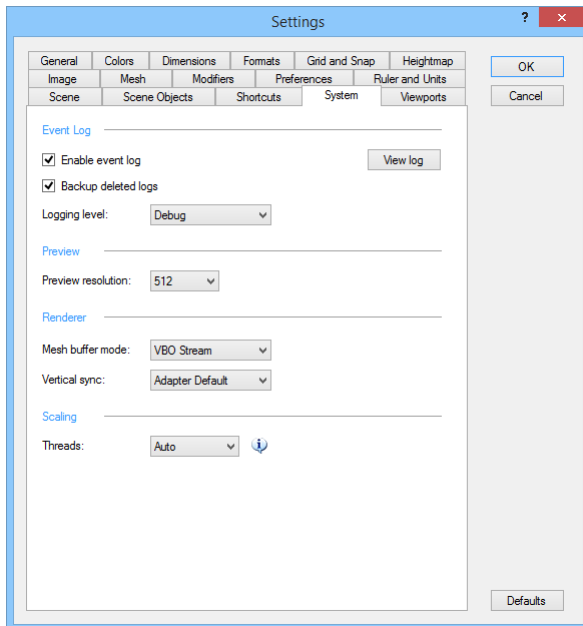


There are no user-configurable settings on this tab.

Settings: System

This tab contains the application system settings.

These are settings related to the low-level operation of the system processor and video hardware rendering.



Event Log

Enable event log: Enable writing of events to the application event log file.
Backup deleted logs: Create a backup copy of prior event logs that are deleted on startup.
Logging level: The level of events that are logged:
Errors, Errors and Warnings, Verbose Information, Enhanced Debug.
View log: Open the Event Log Viewer dialog.

Preview

Preview resolution: The resolution of the preview window heightmap.
Five preview resolutions from 128 to 512 are supported.
Preview resolutions above 256 should only be used on high-end computers.

Renderer

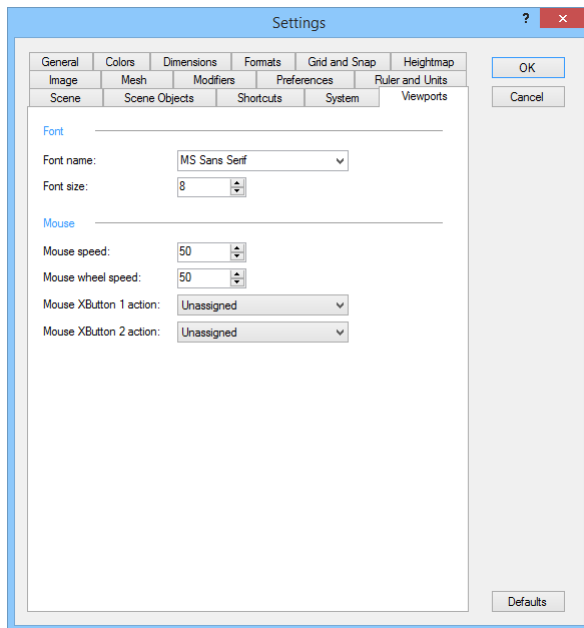
Mesh buffer mode: This is for handling special rendering circumstances and should not be changed.
Vertical sync: Whether the rendering context waits for the display vertical sync.
Note that this setting will not override the vsync setting in the system video driver.
The video driver vsync typically must be set to Application Control for this to work.

Scaling

Threads: The number of processor threads to use for running specific intensive algorithms.
This option should be set to *Auto* to allow TerreSculptor to choose the best setting.
When choosing a specific threads value, typically use the number of logical processors.
This option can be set to a lower number than the number of available system threads to allow concurrent applications to run faster.

Settings: Viewports

This tab contains the application settings for the 3D viewports.



Font

Font name: The viewport text font name.

Font size: The viewport text font size.

Mouse

Mouse speed: The base mouse movement speed.

Mouse wheel speed: The base mouse wheel speed.

Mouse XButton 1 action: The action assigned to mouse X-button 1. A 5+ button mouse is required.

Mouse XButton 2 action: The action assigned to mouse X-button 2. A 5+ button mouse is required.

Cartesian Coordinate Systems

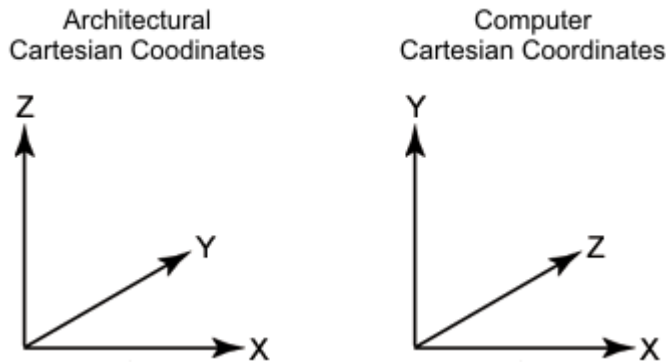
A Cartesian coordinate system specifies a unique point location by its numerical coordinates within a set of planes. The numerical coordinates are the signed (positive or negative) distance from the fixed plane origin to the point's location.

In a 3D coordinate system, the three mutually perpendicular planes are called the X, Y, and Z plane axes, and their point of intersection is called the origin. The origin location is at the X,Y,Z coordinate of 0,0,0, with signed (positive and negative) coordinates at distances from the origin.

Coordinate Categories

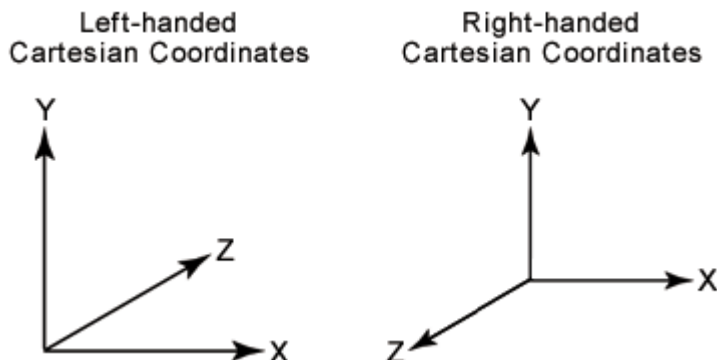
3D Cartesian coordinate systems fall into two basic categories: architectural and computer.

The architectural coordinate system began years ago from hand-drafting where X and Y are the width and length of the paper laying flat on the drafting desk and Z is the imaginary altitude extending upward out of the paper. The computer coordinate system began with the development of 3D rendering engines where X is across the width of the screen, Y is across the height of the screen, and Z is in and out of the screen. An easy way to remember the computer coordinate system is that the Z axis moves along the 3D renderer *Z-buffer* (depth buffer).



All 3D software applications support one or more Cartesian coordinate systems. The chosen coordinate system sometimes depends on the purpose of the software. For example, drafting software such as Autodesk AutoCAD will typically use the architectural coordinate system instead of the default computer coordinate system, since it is an architectural application that is used instead of, or in addition to, hand-drafting. Most software applications and 3D engines use the computer coordinate system.

The computer coordinate system is divided into two layouts, where the only difference is the signed positive direction of the Z axis. The layout where positive Z goes into the screen is called left-handed. DirectX uses the left-handed layout. The layout where positive Z goes out of the screen is called right-handed. OpenGL uses the right-handed layout. The "-handed" terminology comes from the fact that holding your hand in the positive X direction with the fingers curved up in the positive Y direction, then the thumb becomes the positive Z direction.

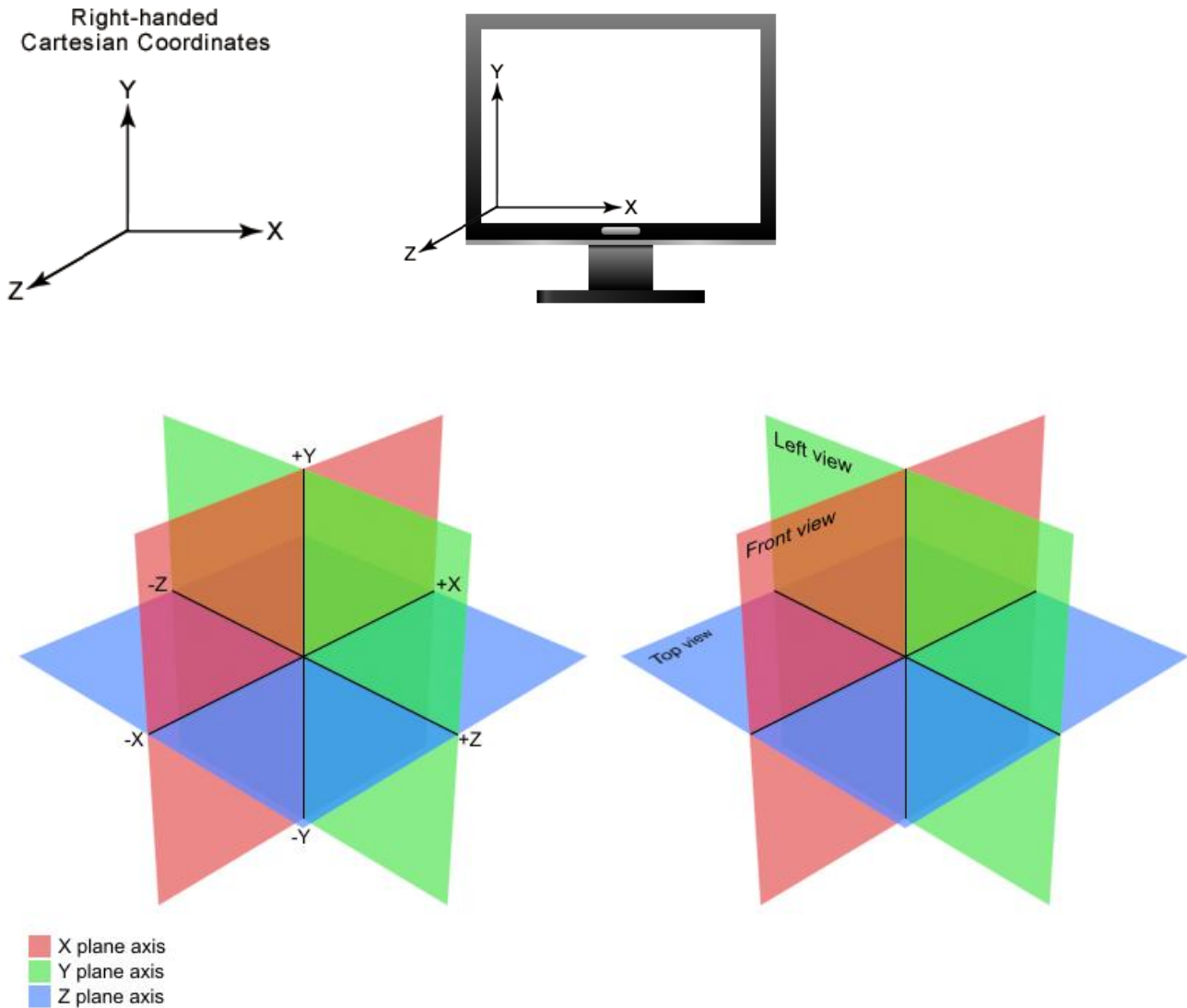


Other common 3D software coordinate default layouts include:

- Autodesk 3DS Max uses the architectural system with +Z up, +X right, +Y in.
- Blender uses Autodesk Max style coordinates.
- Autodesk Maya uses the OpenGL right-handed system with +Y up, +X right, +Z out.
- TerreSculptor uses the OpenGL right-handed system with +Y up, +X right, +Z out.
- Unreal Engine uses its own backwards architectural coordinate system of +Z up, +Y right, +X in, which is why meshes and heightmaps must be pre-rotated prior to import or they do not face the proper direction.

TerreSculptor's Coordinate System

TerreSculptor uses the standard OpenGL right-handed coordinate system with +Y up, +X right, and +Z out. The X,Y,Z origin 0,0,0 is located at the intersection of the three planes.



Display Performance

TerreSculptor contains a number of features to help adjust the performance of the 2D and 3D render display output. The performance features can be set to provide a balance between visual quality and render time.

The performance features are typically set depending on the visual quality requirements and the performance level of the computer hardware.

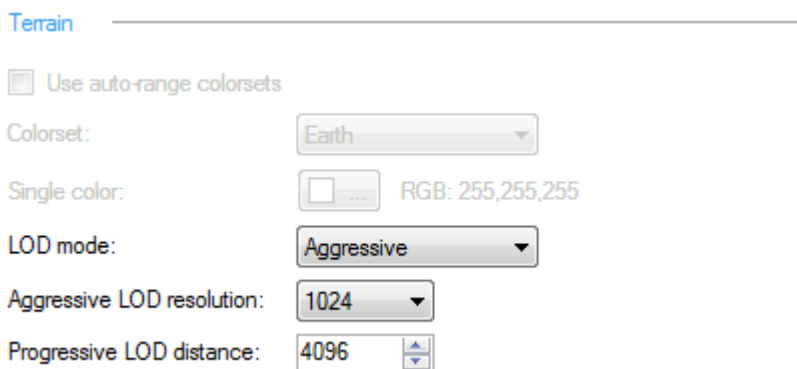
Editor Performance Settings

The Editor 3D scene includes performance settings for the visual quality and resolution of the rendered terrain mesh.

The terrain mesh can be set so that it is a lower resolution proxy version of the actual heightmap data, whenever the heightmap exceeds a specific resolution. This feature is called Aggressive LOD.

When the heightmap resolution exceeds the aggressive resolution value, a smaller version of the heightmap is used to render the terrain mesh. This prevents the mesh triangle count from exceeding the specified maximum, which results in better 3D rendering performance.

The aggressive LOD resolution value can be adjusted on the Options dialog's Scene tab in the Terrain group. Choose the desired largest aggressive LOD resolution, and whenever a heightmap is loaded that is larger than this resolution, it will instead be rendered at this specified resolution. For example, the default aggressive LOD resolution value of 1024 would result in a 2048×2048 or 3072×3072 or 4096×4096 heightmap being rendered at a mesh resolution of 1024×1024. This can be a significant performance savings since a 4096×4096 terrain mesh is more than 33 million triangles, while a 1024×1024 terrain mesh is only 2 million triangles, only 1/16 the amount of mesh data required to render.



The aggressive LOD resolution setting is used in conjunction with the Terrain LOD drop-down menu on the main toolbar. The available terrain LOD modes are chosen on this menu.



Preview Performance Settings

The preview control that is found on many of the editing tools dialogs includes performance settings for the visual quality and resolution of the rendered preview thumbnail.

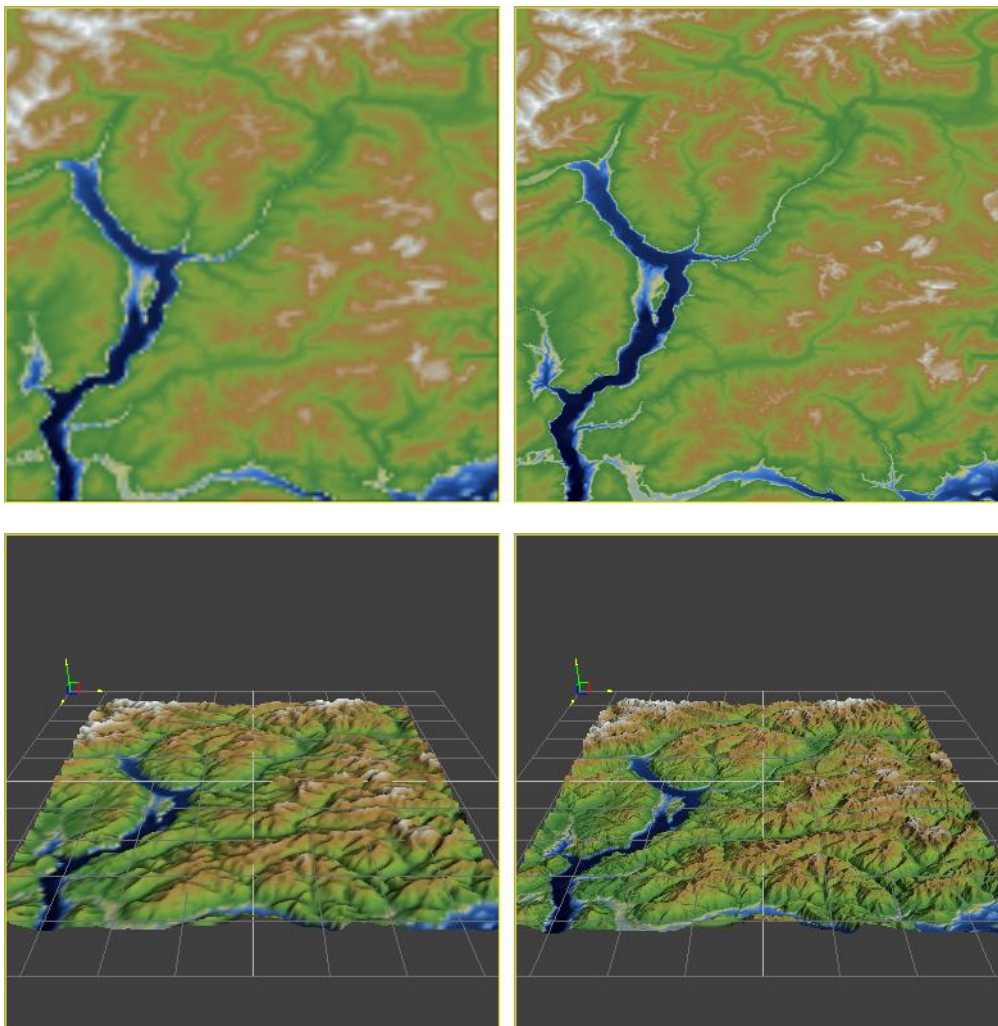
The preview thumbnail resolution can be set to a resolution to provide the desired render quality or performance speed. The preview resolution can also be adjusted for the best performance on a specific computer hardware setup.

The preview resolution value can be adjusted on the Options dialog's System tab in the Preview group.

Five preview resolution values are available that range from 128 to 512. The preview resolution value determines the size of the heightmap, mask, or weightmap preview thumbnail used for the 2D and 3D previews. The smaller the value, the better the performance, but the detail quality will be less. The larger the value, the greater the detail quality will be, but more computer performance will be required to render the preview thumbnail. The default preview resolution value is 256.



The following is a comparison of preview resolutions of 128 (left) versus 512 (right), for top and perspective views.



File Backup

Whenever a file is saved that may cause an overwrite condition, the following actions will occur.

If the application option for *Create backup on save* is enabled, the original file will be renamed from “filename.ext” to “filename.ext.bak”. The characters .bak will be appended to the original file name. This style of action is chosen instead of replacing the original file extension in order that the original file’s format type differentiated by its extension is still obvious.

If a file already exists in the folder that is named “filename.ext.bak”, then it will be deleted, unless the *Use Recycle Bin on overwrite* option is enabled in which case the existing .bak file will be moved to the Windows Recycle Bin.

If the application option for *Create backup on save* is **not** enabled, the original file will be deleted, unless the *Use Recycle Bin on overwrite* option is enabled in which case the original file will be moved to the Windows Recycle Bin.

A flowchart for the operations of both *Use Recycle Bin on overwrite* and *Create backup on save* enabled.



Last Folder Memory

TerreSculptor maintains a memory for the last folder that was accessed for the file open and save dialogs. Whenever the software is executed it always remembers the last folders accessed, and during a session the last folder accessed is always updated to the current folder location that is browsed to.

Last folder memory is tracked independently for each of the following file areas:

Editor:

- Opening and saving a TerreSculptor World file.
- Importing and exporting a file.
- Browsing for a texture file.
- Saving a screenshot image.

Heightmap Converter:

- Opening and saving a file.

Weightmap Editor:

- Opening and saving a file.

Notes:

The last folder memory can be reset to the default folder locations by clicking the Reset button in the Options.

Last folder memory:

The last folder memory is reset whenever the ini file is reset to defaults through the Options dialog. The last folder memory values can be modified by manually editing the ini file.

When the last folder memory for a file area is at its default 'blank' value, the current user account *Documents* folder is used for all files except screenshots which use the current user account *Pictures* folder.

Texture Support

TerreSculptor supports texture mapping on a number of its 3D editor scene objects. The texture image files that can be opened and applied to these scene objects include a subset of standard power-of-two sizes.

The phrase "power-of-two" is often used to specify texture dimensions. Power-of-two numbers are those that are calculated from the formula 2^n where n is any number from 1 and higher. So $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^8 = 256$, $2^{10} = 1024$, $2^{12} = 4096$. etc. Common power-of-two values used for textures include 64, 128, 256, 512, 1024, 2048, and 4096. TerreSculptor supports texture dimension values of 512, 1024, and 2048, as outlined below.

32-bit texture files that include an alpha channel will correctly render with alpha transparency. If a texture file is opened that has an unsupported resolution, the texture resize dialog will appear.

The supported texture file formats include:

Windows Bitmap ".bmp"

- 8-bit palette color (also known as 256-color)
- 24-bit RGB color

Graphics Interchange Format ".gif"

- 8-bit palette color (also known as 256-color)

Joint Photographic Experts Group ".jpg"

- 8-bit palette color (also known as 256-color)
- 24-bit RGB color

Portable Network Graphics ".png"

- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

Targa Image Format ".tga" (*Professional Edition Only*)

- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

Tagged Image Format ".tif" (*Professional Edition Only*)

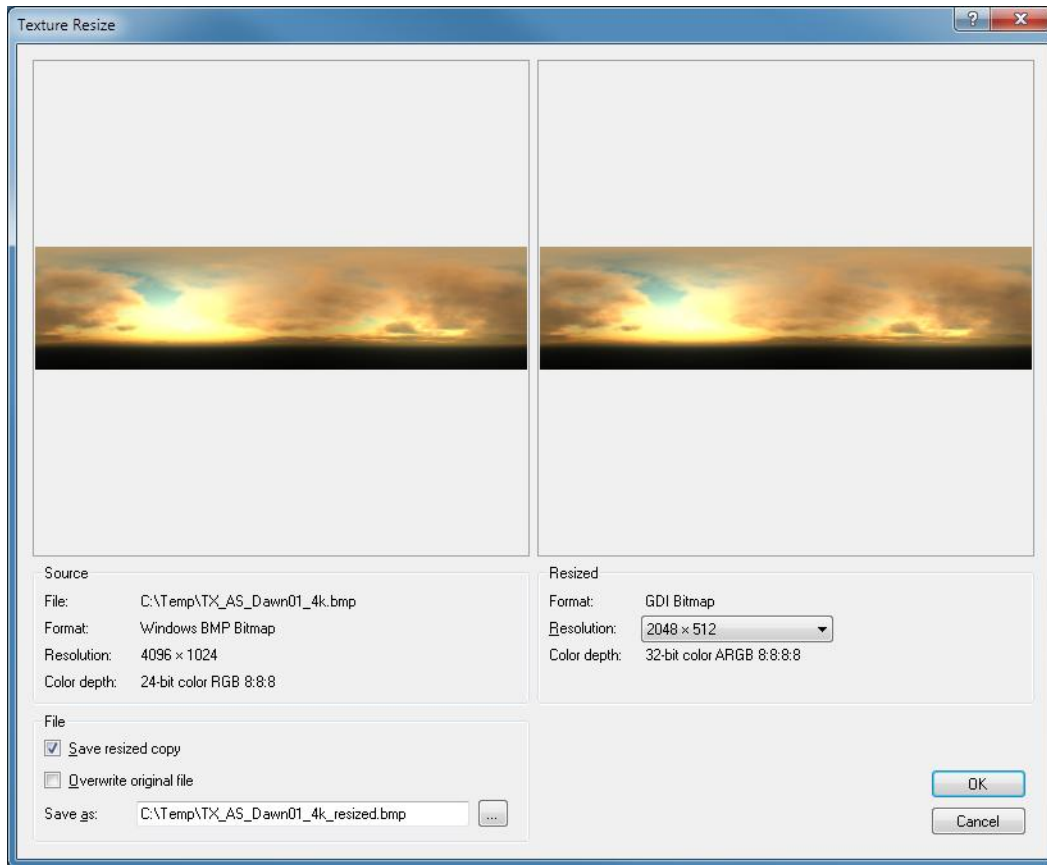
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

The supported texture file resolutions for each scene object are:

Backdrop Cube	512x512, 512x1024, 1024x512, 1024x1024
Backdrop Skydome	2048x512
Backdrop Skyplane	512x512, 1024x1024
Designer	512x512, 512x1024, 1024x512, 1024x1024
Water	512x512, 512x1024, 1024x512, 1024x1024

Texture Resize Dialog

The texture resize dialog supports interactive resampling of texture files that are not one of the supported texture resolutions.



Resized

Resolution – Choose one of the available supported resolutions. The supported resolutions vary by the scene object.

File

Save resized copy – Enable this to save a copy of the resized texture file. If this is not enabled, no resized copy is saved to disk, and resizing will have to be performed again if the original texture is opened at a later time.

Overwrite original file – Enable this to overwrite the original texture file with the resized version. A backup of the original file will be made if file backups is enabled in the application options.

Save as – Specifies the new name for the saved resized copy. By default the resized copy has the same file name as the original file with the word “_resized” appended to the file name.

UDK Landscape Sizes

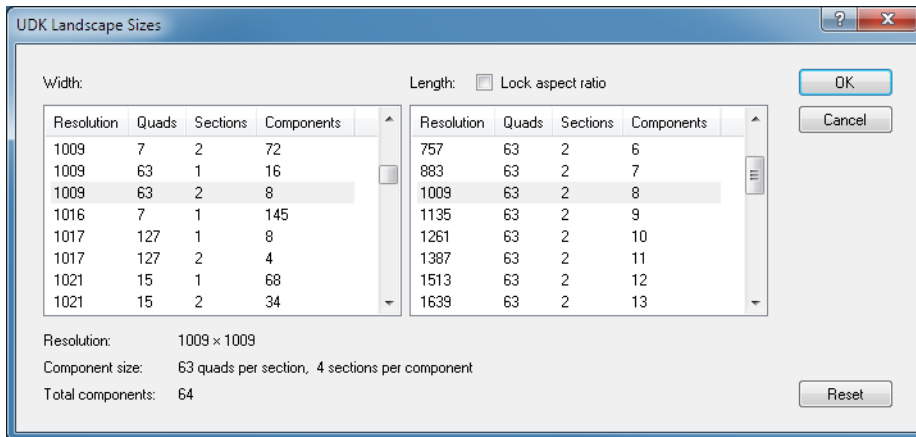
The UDK Landscape Sizes dialog allows choosing a heightmap resolution that is compatible with the Epic Unreal Developer Kit (UDK) Landscape actor.

The UDK Landscape Sizes dialog is available in the Editor when creating a New project or in the Editor and Heightmap Converter when Resampling the current heightmap.

The UDK Landscape Sizes button will be available on the New and Resample dialogs only when the UDK Landscape option is enabled on the Preferences tab Dimensions group.

Dimensions

Show sizes for: Power-of-Two Power-of-Two +1
 PoT/+1 Intermediate UDK Landscape



Width: The heightmap width dimension.
Length: The heightmap length dimension.
Lock aspect ratio: Locks the Length value to the Width value.

Status lines: Displays the selected resolution and Landscape component information.

OK Choose the selected resolution.
Cancel Cancel the dialog.
Reset Reset the dialog controls to their initial values.

To use the UDK Landscape Sizes dialog, first choose the desired Width dimension. The Length list will then fill with all of the length dimensions that are compatible with the chosen width. Choose the desired Length dimension. If the Total number of components listed in the status area is more than 1024, choose a different set of dimensions.

See the Epic UDK Documentation for additional information on using Landscape.

Viewport Stats

The viewport stats display technical information regarding the current scene.

```
RT: 1.115 ms | FT: 30.208 ms
Scene objects: 8
Terrain sections: 225
Terrain triangles: 25905602
```

Performance Statistics

The performance statistics display the current scene render time (RT) and frame time (FT). The render time is the amount of time spent preparing, batching and rendering the scene objects. The frame time is the delta-time interval between subsequent calls to render the scene.

The performance statistics can be displayed in either milliseconds or frame per seconds. Milliseconds is a more accurate statistical value as frames per second in a non-linear function.



The render engine is not a constant iterative loop method and is only updated when camera or scene changes occur. The frame time delta value is relevant only if the scene is constantly updated such as constant camera movement.

Scene Statistics

The scene statistics display information regarding the scene objects, which includes:

- The number of scene objects rendered.
- The number of terrain sections rendered.
- The number of terrain triangles rendered.

Viewport Stats Options

The viewport stats display is managed through the Options dialog Scene tab settings. The performance statistics and scene statistics can be shown or hidden. The performance statistics can be displayed as either milliseconds or frames per second.

Stats

Show performance statistics

Performance units:

milliseconds ▼

Show scene statistics

Benchmark

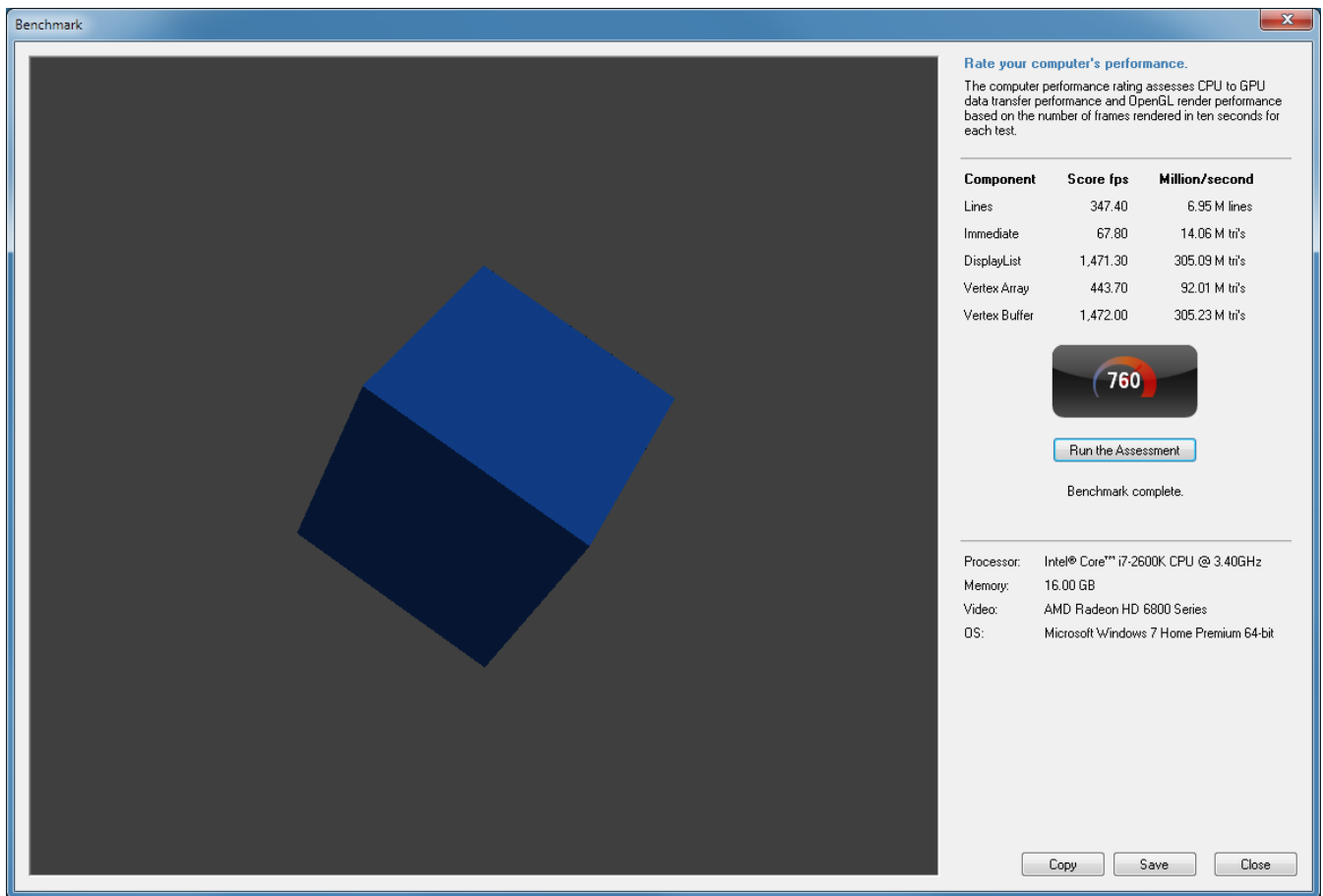
The benchmark dialog runs a test of the computer system's data transfer and rendering performance.

Choose the Benchmark item on the Tools menu to launch the Benchmark dialog. Click on the *Run the Assessment* button to start the benchmark. The benchmark process will require approximately one minute to complete.

The score fps is the number of frames per second achieved while rendering a specific component type. The million/second is the millions of lines or triangles rendered per second. The computer system's final benchmark score number will be displayed in the speedometer graphic. The score number is an average of all of the results from the individual component tests.

The most important rating in the benchmark is the Vertex Buffer score as this is the most common 3D entity type used by TerreSculptor.

The TerreSculptor online Wiki web site contains a listing of benchmark scores performed on a variety of computer systems, which can be used as a comparative guide.



The screenshot shows a window titled "Benchmark" with a dark gray background. In the center, a 3D cube is rendered with blue and dark blue faces. On the right side, there is a white panel with the following content:

Rate your computer's performance.
The computer performance rating assesses CPU to GPU data transfer performance and OpenGL render performance based on the number of frames rendered in ten seconds for each test.

Component	Score fps	Million/second
Lines	347.40	6.95 M lines
Immediate	67.80	14.06 M tri's
DisplayList	1,471.30	305.09 M tri's
Vertex Array	443.70	92.01 M tri's
Vertex Buffer	1,472.00	305.23 M tri's

A speedometer graphic displays the score **760**.

Benchmark complete.

Processor: Intel® Core™ i7-2600K CPU @ 3.40GHz
Memory: 16.00 GB
Video: AMD Radeon HD 6800 Series
OS: Microsoft Windows 7 Home Premium 64-bit

Event Log

TerreSculptor includes an event log system that is useful for both troubleshooting software issues and for obtaining general application operational status information.

Event Log Settings

The application Options dialog includes a number of settings for controlling the operation of the event log. The event log settings are located on the Options dialog's System tab.



- Enable event log** Enable writing of events to the application event log file.
- Backup deleted logs** Create a backup copy of prior event logs that are deleted on startup.
- Logging level** The level of events that are logged:
Errors only, Warnings and Errors, Verbose Information, Enhanced Debug.
- View log** Open the Event Log Viewer dialog.

The View Log button allows for opening the Event Log Viewer dialog while in the Options. The Event Log Viewer dialog is typically accessed through the Tools menu.

Event Log Levels

The event log contains a variety of application events that fall into five different levels of event importance.

- System:** Important events that are always written to the event log.
- Debug:** Extended information for application debugging purposes.
- Error:** Fatal errors that halt the execution of the application or cause an app crash message.
- Warning:** Non-fatal warnings for severe events that the application attempts to handle.
- Information:** General verbose messages for the operation and status of the application.

On slower computers or systems with smaller hard drive space it is recommended to set the Logging Level option to *Errors only* or *Warnings and Errors* only. Setting the Logging Level option to *Verbose Information* or *Enhanced Debug* will cause the application to spend additional processing time writing to the log file, and the log file size will increase substantially.

Event Log File Format

The event log file contains an identification header line followed by the event entries. It is not recommended to edit the event log file while the application is running.

The general format of the event log file entries is:

Event Date and Time	Event Level	Event ID	Source Class	Event Message
yyyy.mm.dd hh:mm:ss	see above	32-bit ID number	class name	event text message

Event Log File Location

The event log file is located in the same folder as the application ini file.

The parent folder may be hidden in Windows Explorer by default.

For Windows XP this folder is located at:

`C:\Documents and Settings\user>\Local Settings\Application Data\TerreSculptor\`

For Windows Vista and Windows 7 this folder is located at:

`C:\Users\user>\AppData\Local\TerreSculptor\`

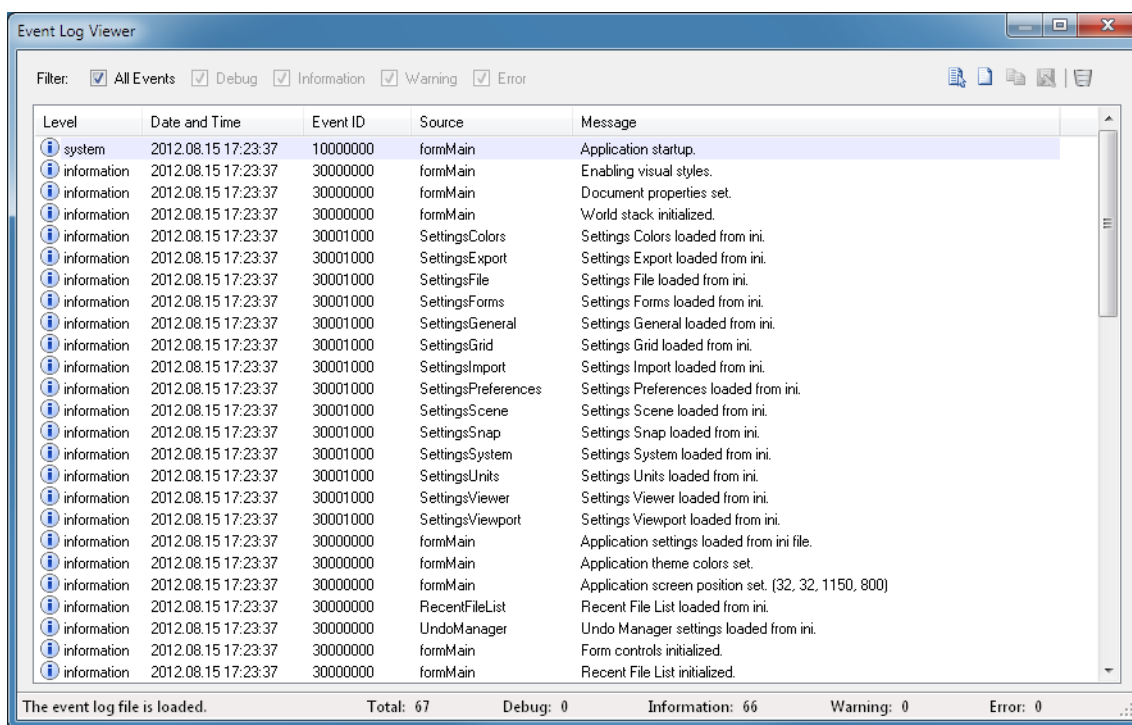
The name of the log file is TerreSculptor.log.

A new log file is generated every time that the TerreSculptor application is ran, and the previous log file is deleted and overwritten. If the *Backup deleted logs* option is enabled, the previous event log file is renamed as a backup by appending the file extension `.bak`. And any prior event log backup file will be sent to the recycle bin.

Viewing the Event Log

The Event Log Viewer is displayed by either choosing the View Event Log item on the Tools menu, or by clicking on the View Log button in the application Options System tab.

The Event Log Viewer dialog contains four regions of controls: the filter options, the edit toolbar, the event list, and the status bar.



Filter Options

The filter options allow you to filter the event levels that appear in the event list.

Selecting the All Events checkbox displays all events in the list.

Deselecting the All Events checkbox and selecting any combination of Debug, Information, Warning, or Error, displays only those event level types in the list.

Edit Toolbar

The edit toolbar contains functions for working with the event list.



Select all

Select all of the events in the list.

Select none

De-select all of the events in the list.

Copy events

Copy the selected events to the clipboard.

Save events

Save the selected events to a text file.

Clear event log

Clear the entire event log.

Event List

The event list contains all of the current event log entries, as specified by the Filter selections. The event log entries are color-coded by event level, and include a customized icon for each event type.

A mouse button right-click on the event list will display a context-sensitive menu that contains most of the edit toolbar functions.

Status bar

The status bar contains information and statistics on the current event log entries.

Software Update

TerreSculptor includes a feature for checking the Internet for updates and new versions of the software.

The software update check can be performed manually by choosing the *Check online for Updates...* item on the Help menu, or by enabling the automatic check for updates in the application options.

Software Update Settings

The application Options dialog includes a setting for enabling the automatic check for software updates. The software update setting is located on the Options dialog's General tab.



Automatic Software Update Checks

The software update checks will occur automatically if the setting has been enabled in the options. The first check occurs thirty seconds after the software has been launched, and then every hour after that if the software update notification icon is ignored. If the software update notification icon is either clicked or double-clicked with the mouse, the automatic update checks are turned off until the next time TerreSculptor is ran.



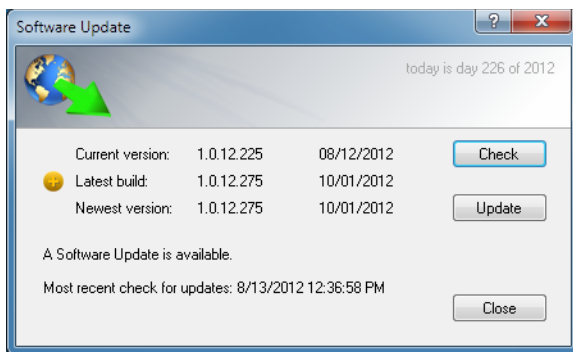
This icon will appear on the right side of the editor toolbar when a download is available.



This icon will appear on the right side of the editor toolbar when an error occurred checking.

Software Update Dialog

The software update dialog can be displayed by choosing the *Check online for Updates...* item on the Help menu, or by double-clicking on the automatic software update notification icon if it is visible. Displaying this dialog does not automatically check for software updates, the Check button must be chosen.



- Check** Check the Internet for an update or new software version.
- Update** Launch the default web browser to the software download page.
- Close** Close the software update dialog.

Terrain Design

TerreSculptor supports creation of a wide variety of visual styles of terrain, from imported DEM digital elevation models, to complex noise generation, to mixing and masking of multiple sources. TerreSculptor utilizes the heightmap based terrain system that can visually depict hills, valleys, mountains, rivers, and roads. Plus the creation of multiple types of weightmaps for a multiple layer terrain texture system that supports real-world texture files such as dirt, rock, sand and mud. The weightmap alphamaps determine where the textures are blended onto the terrain mesh such as on flatlands or steep mountain sides.

Terrain Use

Terrain can be used for small areas such as city lots, enclosed courtyards and even to simulate piles of debris; or the entire game map may be based on a large outdoor terrain design that incorporates a variety of geological features such as mountains and valleys.

The terrain is often used in conjunction with specifically-designed geological meshes for large boulders, buttes, cliffs, and water planes. Additional meshes are also used for the variety of foliage that may appear on the terrain, such as grass, weeds, flowers, shrubs and bushes, and trees. Video game map designs and layouts using terrain will often utilize the terrain's ability to create impassable mountains or cliffs around the circumference of the play area, in order to restrict the movement of the game player and prevent them from leaving the game area or falling out of the game world.

The terrain system essentially renders an $X \times Z$ array of mesh triangles whose vertex Y value determines the altitude of the triangles at each vertex intersection. The vertex Y values are derived from each heightmap pixel altitude or the pixel grayscale level value.

One of the challenges that video game level designers face is choosing the appropriate layout and resolution of this terrain mesh in order to provide the best visual quality versus performance setting.

Terrain Size

Professional Edition: TerreSculptor supports a maximum world size of $1M \times 1M \times 1M$ ($1048576 \times 1048576 \times 1048576$) generic units, although terrain meshes twice this size can still be created or edited but may result in render distance clipping. This is equivalent to a $20.97\text{km} \times 20.97\text{km}$ area when using the Units settings of 1 unit = 2 cm.

Standard Edition: TerreSculptor supports a maximum world size of $256k \times 256k \times 256k$ ($131072 \times 131072 \times 131072$) generic units. This is equivalent to a $5.24\text{km} \times 5.24\text{km}$ area when using the Units settings of 1 unit = 2 cm.

This maximum world size is independent of the heightmap resolution, such that a 2048×2048 heightmap with a Units XZ vertex spacing of 128 will result in a $256k \times 256k$ area, while the same 2048×2048 heightmap with a Units XZ vertex spacing of 256 will result in a $512k \times 512k$ area.

The Units XZ vertex spacing value determines the size of each terrain quad, along with the terrain heightmap resolution in pixels ultimately determining the total area of the terrain mesh. The total area is calculated as heightmap resolution \times Units XZ vertex spacing along each dimension. Choosing the most effective set of values for heightmap resolution and vertex spacing is required to obtain the best balance between terrain detail and rendering performance.

In most cases the Units XZ vertex spacing will be 128, 192, or 256, which provide a good balance between quad size and terrain mesh density. The heightmap resolution will then be chosen to fulfill the requirement for the overall terrain size such as the area in meters or kilometers.

Care should be exercised when choosing heightmaps larger than 1024×1024 for both performance and file size reasons: a 2048×2048 heightmap is 8MB of heightmap data and a terrain mesh of 8 million triangles; a 3072×3072 heightmap is 18MB of heightmap data and a terrain mesh of 18 million triangles; and a 4096×4096 heightmap is 32MB of heightmap data and a terrain mesh of 32 million triangles.

Power-of-Two

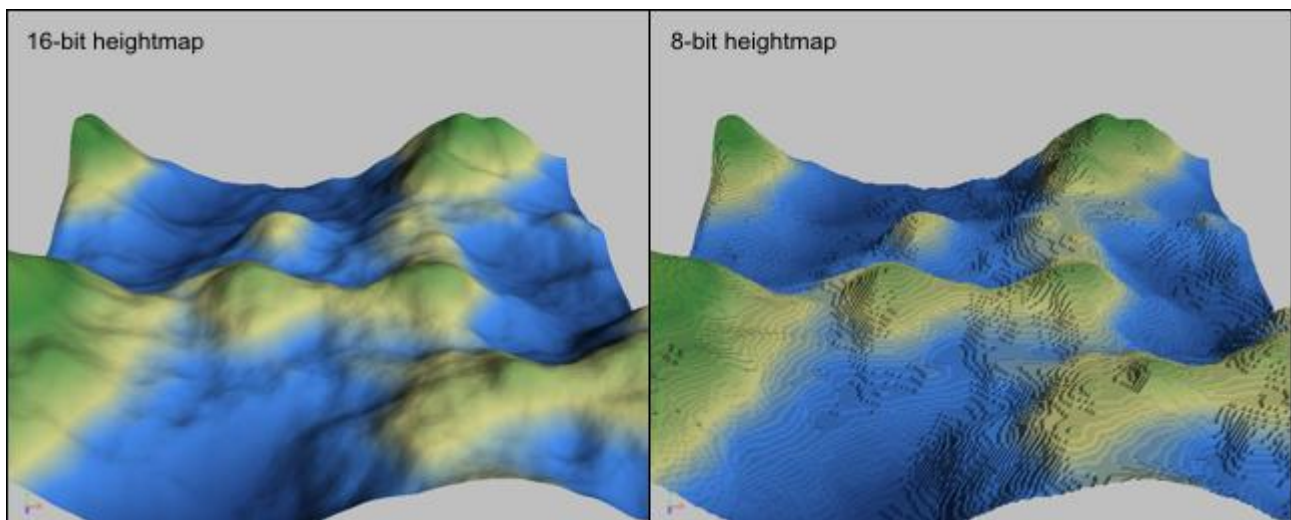
When working with heightmaps the phrase "power-of-two" is often used to specify the heightmap dimensions. Power-of-two numbers are those that are calculated from the formula 2^n where n is any number from 1 and higher. So $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^8 = 256$, $2^{10} = 1024$, $2^{12} = 4096$. etc.

Common power-of-two values used for heightmaps include 64, 128, 256, 512, 1024, 2048, and 4096. Plus-half values are also commonly used, which are those half-way between a power-of-two pair, such as 384, 768, 1536, and 3072.

Heightmap Bit-depth

When developing heightmap files for use with current video game engines, be sure to always work with the proper 16-bit heightmap format and files. Choosing to work with 8-bit grayscale heightmap files for ease of support in standard paint software will result in terrains that are using only 1/256th of the available altitude range. This normally causes an undesirable stair-stepped terracing look to the terrain.

When working with heightmap files, it is not recommended to attempt to paint detail on the heightmap using standard paint software, as it can only edit and display 8-bits of grayscale on current video hardware. This means that for every single color of gray that is painted on an 8-bit display system, there are actually 256 levels of altitude that cannot be seen visually. In other words, on an 8-bit grayscale display, the value 0 (black) is actually the 16-bit values from 0 to 255; the 8-bit value 1 is actually 16-bit 256 to 511, etc. So there is no visual accuracy to the values that are being painting to.



Units Vertex Spacing

The Units vertex spacing includes individual properties for the XZ and Y directions of the terrain mesh. Units XZ are locked together to create square quads (triangle pairs) only, and affect the width and length of the terrain mesh, while Units Y affects the height (altitude range) of the terrain mesh.

Units XZ

The size of each terrain quad (triangle pair) is determined by the current Units XZ vertex spacing value. The Units XZ value should be adjusted to modify the quad size for the required minimum visual surface resolution.

The Units XZ value chosen will depend on two factors, the desired terrain mesh detail quality, and the desired rendering performance. Higher terrain mesh detail requires a smaller Units XZ value which results in a greater number of quads for a specified terrain area, while faster rendering requires fewer quads for a specified terrain area which is accomplished with a larger Units XZ value.

Units Y

The Units Y vertex spacing value determines the granularity for each terrain mesh vertex position along the Y axis direction (altitude or up and down). The smaller the Units Y value, the finer the terrain altitude steps. The larger the Units Y value, the larger the altitude steps. Since the heightmap data is floating-point values between 0.0 and 100.0, the Units Y vertex spacing also determines the total available altitude range for the terrain.

Terrain Quad Size

The size of each terrain quad is determined by the Units XZ vertex spacing property. This table shows the approximate size in equivalent feet and meters based on the ratio of 1 Unit XZ equals 2 centimeters. Imperial to metric conversion is 1 inch = 2.54 cm.

Units XZ vertex spacing	Terrain mesh quad	Quad size in Meters	Quad size in Feet
64	64 units	1.28 m (128 cm)	4.20 ft (50.39 in)
80	80 units	1.60 m (160 cm)	5.25 ft (62.99 in)
96	96 units	1.92 m (192 cm)	6.30 ft (75.59 in)
112	112 units	2.24 m (224 cm)	7.35 ft (88.19 in)
128	128 units	2.56 m (256 cm)	8.40 ft (100.79 in)
160	160 units	3.20 m (320 cm)	10.50 ft (125.98 in)
192	192 units	3.84 m (384 cm)	12.60 ft (151.18 in)
224	224 units	4.48 m (448 cm)	14.70 ft (176.38 in)
256	256 units	5.12 m (512 cm)	16.80 ft (201.57 in)
288	288 units	5.76 m (576 cm)	18.90 ft (226.77 in)
320	320 units	6.40 m (640 cm)	21.00 ft (251.97 in)
352	352 units	7.04 m (704 cm)	23.10 ft (277.17 in)
384	384 units	7.68 m (768 cm)	25.50 ft (302.36 in)
512	512 units	10.24 m (1024 cm)	33.60 ft (403.15 in)

Terrain Area Size

This table lists the real-world equivalent area of the terrain for various common values of heightmap resolution and Units XZ vertex spacing.

The terrain area is calculated as:

$$\begin{aligned} \text{Heightmap Resolution} \times \text{Units XZ vertex spacing} &= \text{total area in units} \\ \text{Total area in units} \times \text{units type and size} &= \text{total terrain area} \end{aligned}$$

For example: (1024 resolution \times 256 units = 262144 units) \times (1 unit = 2 cm) = 524288 cm = 5.24288 km

For this table data: 1 Unit XZ = 2cm. 1 foot = 30.48cm or 0.3048 meters. 1 meter = 3.280839895 feet. 1000 meters = 1 kilometer. 5280 feet = 1 mile.

To determine the total desired area for a terrain, look up the width and length from this table in meters/kilometers or feet/miles to get the required heightmap resolution and Units XZ vertex spacing.

Heightmap Res.	Units XZ	Length in Units	Meters	Feet
64	128	8192	163.84 (0.16 km)	537.532808
64	192	12288	245.76 (0.25 km)	806.299213
64	256	16384	327.68 (0.33 km)	1075.06562
128	128	16384	327.68 (0.33 km)	1075.06562
128	192	24576	491.52 (0.5 km)	1612.59843
128	256	32768	655.36 (0.66 km)	2150.13123
256	128	32768	655.36 (0.66 km)	2150.13123
256	192	49152	983.04 (0.99 km)	3225.19685
256	256	65536	1310.72 (1.3 km)	4300.26247
384	128	49152	983.04 (0.99 km)	3225.19685
384	192	73728	1474.56 (1.5 km)	4837.79528
384	256	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
512	128	65536	1310.72 (1.3 km)	4300.26247
512	192	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
512	256	131072	2621.44 (2.6 km)	8600.52493 (1.6mi)
768	128	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
768	192	147456	2949.12 (2.9 km)	9675.59055 (1.8mi)
768	256	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1024	128	131072	2621.44 (2.6 km)	8600.52493 (1.6mi)
1024	192	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1024	256	262144	5242.88 (5.2 km)	17201.0499 (3.3mi)
1536	128	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1536	192	294912	5898.24 (5.9 km)	19351.1811 (3.7mi)
1536	256	393216	7864.32 (7.7 km)	25801.5748 (4.9mi)
2048	128	262144	5242.88 (5.2 km)	17201.0499 (3.3mi)
2048	192	393216	7864.32 (7.9 km)	25801.5748 (4.9mi)
2048	256	524288	10485.76 (10.5 km)	34402.0997 (6.5mi)
3072	128	393216	7864.32 (7.9 km)	25801.5748 (4.9mi)
3072	192	589824	11796.48 (11.8 km)	38702.3622 (7.3mi)
3072	256	786432	15728.64 (15.8 km)	51603.1496 (9.8mi)
4096	128	524288	10485.76 (10.5 km)	34402.0997 (6.5mi)
4096	192	786432	15728.64 (15.8 km)	51603.1496 (9.8mi)
4096	256	1048576	20971.52 (21 km)	68804.1995 (13 mi)

Creating Heightmaps for Unreal Engine 2

Performance

Unreal Engine 2 terrains perform sector frustum culling for performance. Terrains do not include any intrinsic occluding functionality, so AntiPortals should be placed beneath large hills and mountains to perform occlusion culling.

X and Y Dimensions

Each sample point in the heightmap image corresponds to a mesh vertex in the terrain. The Unreal Engine 2 TerrainInfo actor only supports power-of-two dimensions, such as 256 × 256. The number of terrain mesh quads generated will always be the dimension -1. A 256 × 256 heightmap therefore results in a 255 × 255 terrain mesh.

Altitude and TerrainScale.Z

When developing heightmaps for use in Unreal Engine 2, rarely will a heightmap utilize the entire 16-bit range of altitude values from 0 to 65535. The Unreal Engine 2 TerrainInfo actor's TerrainScale.Z determines the maximum altitude range that is available. A heightmap can use all 65536 altitude values, but it is usually easier to develop a heightmap that is using its real-world altitude layout in order to more easily visualize the terrain. In most cases, a heightmap with an altitude range that is between 10,000 and 40,000 of the available 16-bits is sufficient.

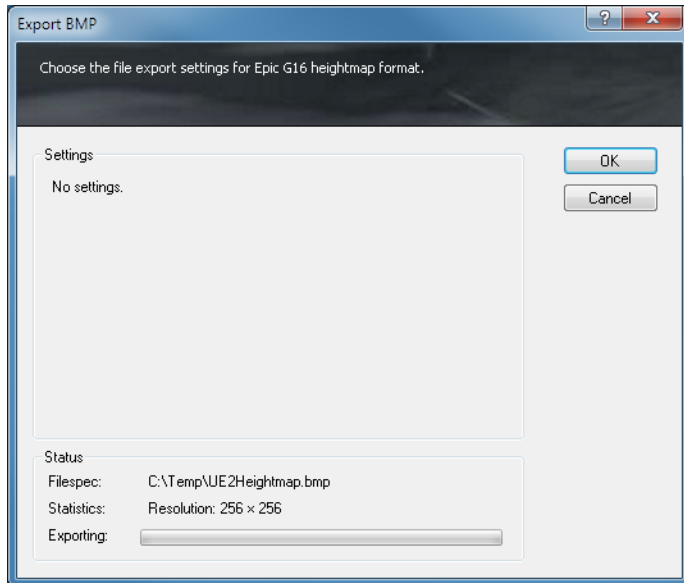
Exporting a Heightmap for Unreal Engine 2

The Unreal Engine 2 TerrainInfo actor supports heightmap importing using the 16-bit G16 format.

Unreal Engine 2 terrain is limited to power-of-two sizes, with common terrain resolutions of 64×64 , 128×128 , and 256×256 . Terrains that are 512×512 or larger are not recommended for performance reasons. Terrains should also be square aspect.

The TerreSculptor heightmap must be the proper dimensions for one of the supported Terrain resolutions. Use the Resample tool to modify the heightmap dimensions before exporting if required.

To create a heightmap file that is compatible with the Unreal Engine 2 TerrainInfo importer, export the TerreSculptor heightmap to the Epic G16 file format. This file format has no additional export properties.



Creating Heightmaps for Unreal Engine 3 UDK

Performance

Large terrains should always be designed with sufficient intrinsic occluding capabilities to provide culling of a large portion of the terrain sections (sectors). This is accomplished by using numerous tall mountains or cliffs in the terrain design so that only a short view-distance is ever rendered in the frustum.

X and Y Dimensions

Each sample point in the heightmap image corresponds to a mesh vertex in the terrain. In order to obtain a terrain that is an even power-of-two size, such as 256 × 256 patches (quads), it is necessary to provide a heightmap that is *size+1* in dimensions. A 256 × 256 patch terrain therefore requires a 257 × 257 heightmap.

Altitude and DrawScale3D.Z

When developing heightmaps for use in Unreal Engine 3, rarely will a heightmap utilize the entire 16-bit range of altitude values from 0 to 65535. The Unreal Engine 3 Landscape/Terrain actor's DrawScale3D.Z determines the maximum altitude range that is available. A heightmap can use all 65536 altitude values, but it is usually easier to develop a heightmap that is using its real-world altitude layout in order to more easily visualize the terrain. In most cases, a heightmap with an altitude range that is between 10,000 and 40,000 of the available 16-bits is sufficient.

Heightmap Altitude Range	DrawScale3D.Z	Unreal Altitude	Altitude Range *
16384 to 49152 (= 32768)	256	65536 units (-32768 to 32768)	1310.72 m or 4300.26 ft
	128	32768 units (-16384 to 16384)	655.36 m or 2150.13 ft
	64	16384 units (-8192 to 8192)	327.68 m or 1075.06 ft
	32	8192 units (-4096 to 4096)	81.92 m or 268.77 ft
	16	4096 units (-2048 to 2048)	40.96 m or 134.38 ft
24576 to 40960 (= 16384)	256	32768 units (-16384 to 16384)	655.36 m or 2150.13 ft
	128	16384 units (-8192 to 8192)	327.68 m or 1075.06 ft
	64	8192 units (-4096 to 4096)	81.92 m or 268.77 ft
	32	4096 units (-2048 to 2048)	40.96 m or 134.38 ft
	16	2048 units (-1024 to 1024)	20.48 m or 67.19 ft

* Based on the default UE3 engine setting of 1 unreal unit = 2 cm.

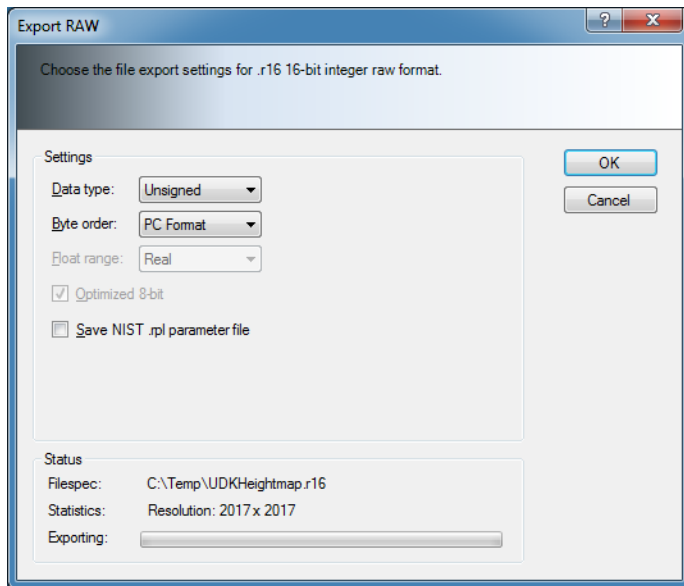
Exporting a Heightmap for UDK Landscape

The UDK Landscape actor supports heightmap importing using the 16-bit RAW .r16 format.

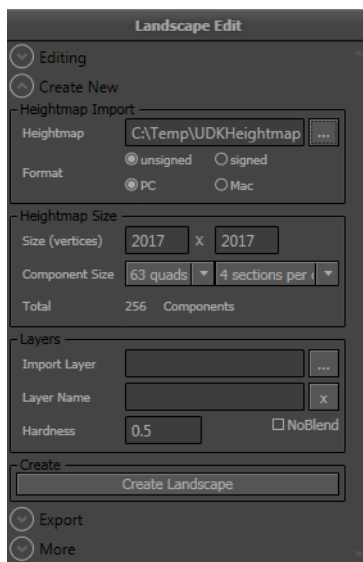
Landscape has an unintuitive method of managing the supported heightmap resolutions. There are only a limited number of resolutions that work, and even fewer that are properly optimized. It is recommended that UDK users seek help regarding this from the UDN documentation and the Epic forums, as Landscape resolution calculations will not be covered in this document.

The TerreSculptor heightmap must be the proper dimensions for one of the supported Landscape resolutions. Use the Resample tool to modify the heightmap dimensions before exporting if required.

To create a heightmap file that is compatible with the UDK Landscape importer, export the TerreSculptor heightmap to the 16-bit RAW .r16 file format using the following export properties: *Unsigned, PC format*. Optionally the *Signed* or *Mac Format* may also be used, just be sure to use the identical format options on the UDK Landscape Edit dialog importing.



The exported heightmap file is then imported into UDK Landscape using the Landscape Edit dialog. In the Landscape Edit dialog's *Create New* group, browse for the .r16 file in the *Heightmap Import* group, and set the Format options accordingly: *Unsigned, PC*. Choose the *Create Landscape* button to create a new Landscape with the imported heightmap.



Notes

- To match the viewport terrain rendering scale between TerreSculptor and UDK, be sure to set the TerreSculptor Units properties on the Options dialog to the UDK Units that your specific engine version is using. The default UE3 UDK Units are available in the Units Preset drop-down combobox as *Unreal Engine 3*.
- If the Landscape heightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap import process repeated.
- If the Landscape is to include Layer weightmap files, they must be imported at the same time as the heightmap. If any Landscape weightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap and weightmap import process repeated. See the chapter on *Exporting a Weightmap for UDK Landscape*.

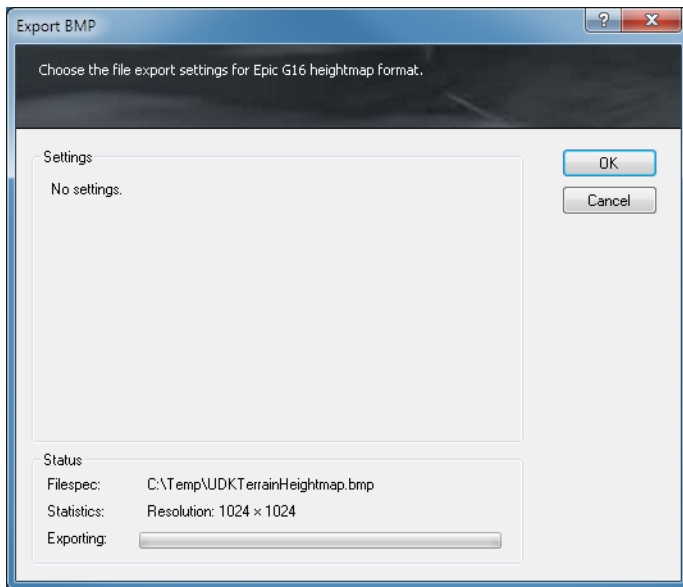
Exporting a Heightmap for UDK Terrain

The UDK Terrain actor supports heightmap importing using the Epic G16 .bmp format.

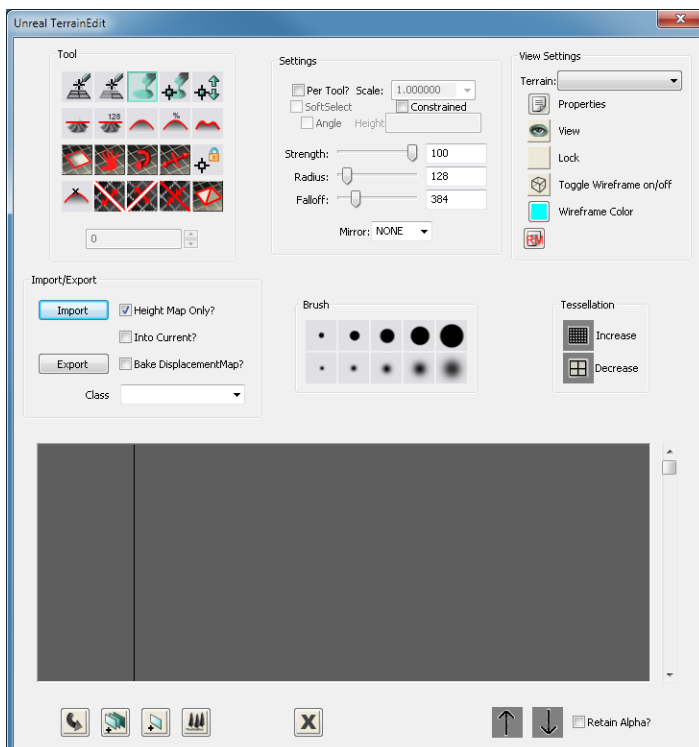
The Terrain actor supports any resolution from 2 × 2 up to 1024 × 1024. It is not recommended to use Terrain actors larger than 1024 due to performance overhead.

The TerreSculptor heightmap must be the proper dimensions for the desired Terrain actor resolution. Use the Resample tool to modify the heightmap dimensions if required before exporting.

To create a file that is compatible with UDK Terrain, export the TerreSculptor heightmap to the Epic G16 format. There are no additional property settings for this format.



The exported file is then imported into UDK Terrain using the Terrain Edit dialog. Under the Import/Export group, enable the Height Map Only checkbox and then Import the G16 .bmp file.



Notes

- To match the viewport terrain rendering scale between TerreSculptor and UDK, be sure to set the TerreSculptor Units properties on the Options dialog to the UDK Units that your specific engine version is using. The default UE3 UDK Units are available in the Units Preset drop-down combobox as *Unreal Engine 3*.
- If the Terrain heightmap requires updating, perform the import process again with the Terrain actor selected and set the *Into Current?* option enabled.

Creating Weightmaps for Unreal Engine 3 UDK

Unreal Engine 3 weightmaps are 8-bit grayscale alphamaps used to determine the placement of texture materials on the terrain.

TerreSculptor has intrinsic functions for creating weightmaps that are fully compatible with UE3. These weightmaps can be based on limits of the terrain's altitude range, the direction that terrain triangles are facing, the terrain triangle slope, and composite weightmaps that are any combination of these.

Weightmaps based on altitude range can be used for snow-capped mountains and ocean floors. Weightmaps based on direction can be used to simulate where solar or weather effects have affected the surface. Weightmaps based on slope can be used for rock cliff edges or grass filled plains.

Each weightmap should be unique, in that its coverage should not overlap any other weightmaps. For example, a weightmap for cliff faces would use a slope range between ~70 and 90 degrees, whereas a weightmap for grassy plains would use a slope range between 0 and ~30 degrees.

It is possible to mix algorithmically generated weightmaps with hand-painted layers. Care must be exercised when performing the hand-painting in order that the algorithmic weightmap is not inadvertently modified.

Exporting a Weightmap for UDK Landscape

The UDK Landscape actor supports layer weightmap importing using the 8-bit RAW .r8 format.

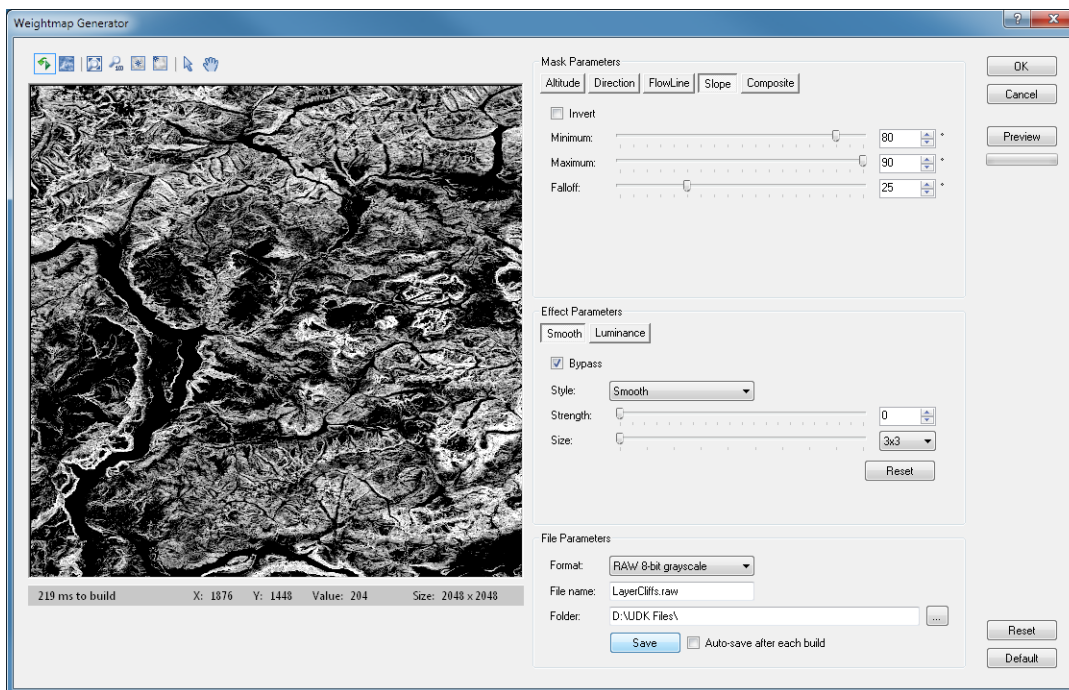
Landscape layer weightmaps must be the same resolution as the RAW heightmap file that is imported into the Landscape Edit dialog. If the TerreSculptor heightmap was resampled prior to exporting for use in Landscape, then the weightmaps must be extracted from the resampled heightmap, or resampled manually in the Weightmap Editor (*Professional Edition Only*) or third-party paint software.

For immediate mode, choose the Weightmap Generator from the toolbar, create the desired weightmap type by choosing the appropriate dialog control properties, set the required *File Parameters*, and choose the *Save* button to save the weightmap file to disk.

For stack mode, add a new Weightmap Generator object to the World Stack, edit the object and create the desired weightmap type by choosing the appropriate dialog control properties, set the required *File Parameters*, and choose whether to *Auto-save* the weightmap file after each build or to manually save the weightmap file by choosing the *Save* button.

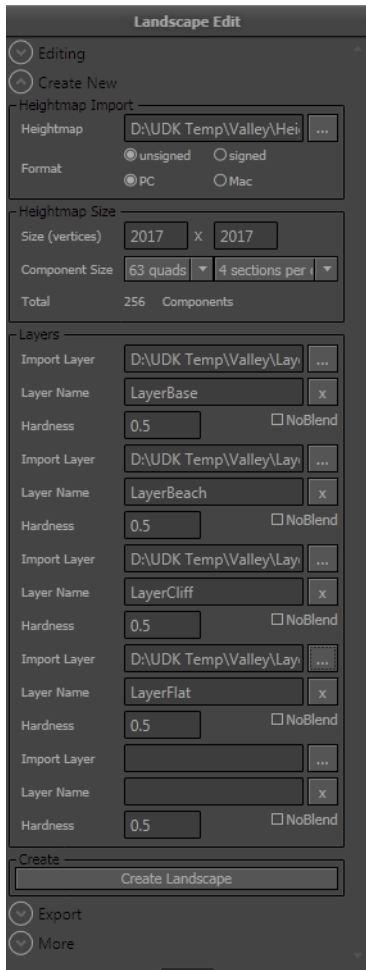
To create a weightmap file that is compatible with UDK Landscape's importer, save the TerreSculptor weightmap to the 8-bit RAW .r8 file format using the Weightmap Generator dialog's File Properties:

- Format: R8 8-bit grayscale
- File name: the desired layer name which should relate to the weightmap type, eg. LayerFlatland.raw
- Folder: the folder where the UDK heightmap and weightmap project is being created



The exported weightmap file is then imported into UDK Landscape using the Landscape Edit dialog. When importing layer weightmaps, the entire heightmap and all layer weightmaps must be imported at the same time.

In the Landscape Edit dialog's *Create New* group, browse for the .r16 file in the *Heightmap Import* group, and set the Format options accordingly, then for each layer weightmap, browse for the .raw file in the *Layers* group, and set the layer properties as desired. The *Layer Name* property will be the weightmap file name by default. Choose the *Create Landscape* button to create a new Landscape with the imported heightmap and weightmaps.

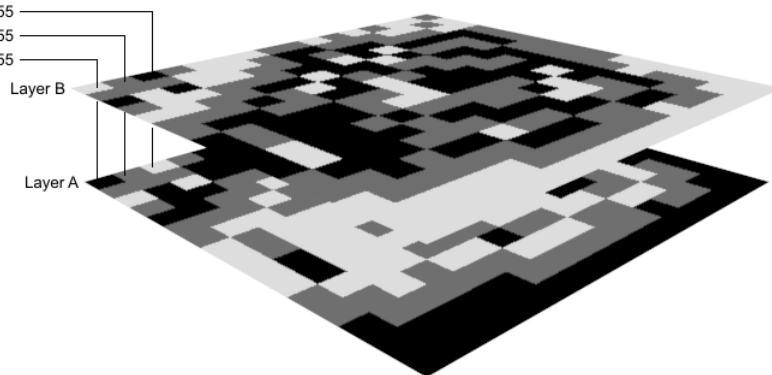


Notes

- A proper Landscape layer weightmap setup requires that each weightmap be unique regarding its mask alphamap data. In other words, there is no weightmap layering order, and each weightmap pixel when layered one weightmap on top of each other, should add up to a value of 255 (1.0).

For example, if there are four weightmaps named A, B, C, and D, and the pixel value at XY 0,0 on weightmap A is 255, then the pixel value at XY 0,0 on weightmaps B, C, and D must be 0. If the pixel value at XY 0,1 on weightmap A is 155, then the combined pixel values at XY 0,1 on weightmaps B, C, and D must be 100.

Layer A: 255 + Layer B: 0 = 255
 Layer A: 128 + Layer B: 127 = 255
 Layer A: 0 + Layer B: 255 = 255



This prerequisite for additive layer weighting in Landscape requires that the final weightmap files be modified and composited correctly using the Weightmap Editor (*Professional Edition Only*) or third-party paint software. See the chapter on *UDK Landscape Layer Compositing* for the required steps to create a proper weightmap layer set.

- The Landscape Layer weightmap files must be imported at the same time as the heightmap. If any Landscape weightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap and weightmap import process repeated.

Tutorial: How to Convert a Heightmap file format



This is an *Immediate Mode* tutorial.

Converting a heightmap involves opening a file of one specific format and saving it to another format. This is often performed when sourcing files from one application for use in a second application. For example: converting digital elevation model files for use with Unreal Engine 3 terrains.

If the heightmap is equal or smaller than the 3D Editor maximum supported dimensions, then the conversion can be performed using the editor. If the heightmap is larger than the 3D Editor maximum supported dimensions, then the Heightmap Converter dialog can be used (*Professional Edition Only*).

Using the 3D Editor

Import the source heightmap file:

Note: imported heightmaps automatically use the Stack Base Heightmap slot and will overwrite any data there.

1. Choose the **Import** item on the File menu.
2. Select the source file format from the Import Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Export the destination heightmap file:

1. Choose the **Export** item on the File menu.
2. Select the destination file format from the Export Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Using the 2D Converter

Note: *Professional Edition Only*.

Open the source heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Save the destination heightmap file:

1. Choose the **Save As** item on the File menu, or click on the Save As toolbar button.
2. Select the destination file format from the Save Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Tutorial: How to Open, Edit, and Save a Heightmap file



This is an *Immediate Mode* tutorial.

Editing a heightmap is often required if the size or altitude range or other heightmap property must be adjusted.

Using the 3D Editor

Import the source heightmap file:

Note: imported heightmaps automatically use the Stack Base Heightmap slot and will overwrite any data there.

1. Choose the **Import** item on the File menu.
2. Select the source file format from the Import Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Edit the heightmap data:

1. Choose the desired editing functions on the **Adjust, Modify, Transform** menus.
This includes transforms, altitude, filter, resample, size, etc.

Export the destination heightmap file:

1. Choose the **Export** item on the File menu.
2. Select the destination file format from the Export Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Using the 2D Converter

Note: *Professional Edition Only*.

Open the source heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Edit the heightmap data:

1. Choose the desired editing functions on the **Adjust, Modify, Transform** menus.
This includes transforms, altitude, filter, resample, size, etc.

Save the destination heightmap file:

1. Choose the **Save As** item on the File menu, or click on the Save As toolbar button.
2. Select the destination file format from the Save Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Tutorial: How to create Weightmaps from an existing Heightmap file



This is an *Immediate Mode* tutorial.

Weightmaps, also called alphamaps or masks, are commonly used in video game terrain systems to define the locations of the various texture materials that cover the surface of the terrain.

Weightmaps can be algorithmically generated or hand-painted. Common algorithmically generated weightmaps include alpha selection by altitude or slope, and are used for such terrain features as rock cliff faces, grass flatlands, and lake beds. TerreSculptor supports a number of algorithmic functions and options for weightmap creation.

Open the heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Create a weightmap:

1. Choose the Weightmap Generator button on the toolbar.
2. Choose the weightmap mask type tab button.
3. Modify the weightmap parameters as desired, using the preview as a guide.

Save the weightmap file:

The File Parameters for the weightmap generator will always default to the same folder as the imported heightmap file.

1. Choose the weightmap format in the File Parameters group.
2. Type in the weightmap destination file name.
3. Change the default weightmap file folder if desired.
4. Select the **Save** button to launch the File Save dialog and save the weightmap file to disk.

Appendix A: File Format Export and Import Options

TerreSculptor supports a wide range of file formats including digital elevation model, heightmap, image, mesh and raw data. Each file format may support a number of other exporting and importing features as outlined below.

Auto-scale

Type: Import
Applies to: image, heightmap
Settings: True or False
Description: Automatically scales the imported 8-bit data into the 0.0 to 100.0 range.

Byte Order

Type: Import and Export
Applies to: image, dem, heightmap
Settings: Intel (PC, little-endian) or Motorola (Mac, big-endian)
Description: Determines the byte-order of 16-bit and 32-bit data as per Intel or Motorola format.

Data Type

Type: Import and Export
Applies to: image, dem, heightmap
Settings: 8-bit Unsigned Byte, 16-bit Signed and Unsigned Short, 32-bit Signed and Unsigned Integer, 64-bit Signed and Unsigned Long, 32-bit Signed and Unsigned Single float, 64-bit Signed and Unsigned Double Float.
Description: Determines the data type size and Signed or Unsigned format.

Format

Type: Import and Export
Applies to: image, dem, heightmap, mesh
Settings: vary by the file type
Description: Selects a specific format type for a file, such as Grayscale or RGB, or ASCII or Binary.

Float Range

Type: Import and Export
Applies to: image, heightmap
Settings: Real (0.0...100.0) or Scaled (0.0...1.0)
Description: Determines whether the 32-bit data is stored as Real or Scaled range.

Include Object Name

Type: Export
Applies to: mesh (.obj)
Settings: True or False
Description: Determines whether the mesh information includes a Mesh Object Name.

Include Smoothing Group

Type: Export
Applies to: mesh (.obj)
Settings: True or False
Description: Determines whether the mesh information includes a Smoothing Group.

Integer Range

Type: Import and Export
Applies to: image, heightmap
Settings: 8-bit (0...255) or 16-bit (0...65535)
Description: Determines whether the float data is stored in 8-bit or 16-bit range.

Line Length

Type: Export
Applies to: dem, heightmap, mesh
Settings: up to 393216 (384k) characters per line, but usually Heightmap Width * 4 (8-bit) or * 6 (16-bit)
Description: Specifies the maximum number of text characters per line for text format files.

Optimized 8-bit

Type: Export
Applies to: image, heightmap
Settings: True or False
Description: Scales the float data into an optimized 8-bit range.

Orientation

Type: Export
Applies to: image
Settings: Left-to-Right, Right-to-Left, Top-to-Bottom, Bottom-to-Top
Description: Determines the orientation (rotation or flip) of the image data.

Reverse Vertex Order

Type: Export
Applies to: mesh
Settings: True or False
Description: Determines whether the mesh vertices are written counterclockwise (False) or clockwise (True).

Rotate Mesh Origin

Type: Import and Export
Applies to: mesh
Settings: True or False
Description: Determines whether the mesh is oriented bottom-left (False) or top-left (True).

Source (color plane)

Type: Import and Export
Applies to: image
Settings: Grayscale, Red, Green, Blue, or Alpha
Description: Determines the data color plane to read from or write to.

Text Encoding

Type: Import and Export
Applies to: dem, heightmap, mesh
Settings: ASCII, Unicode, UTF-8
Description: Determines the text character format to read from or write to.

Type Conversion

Type: Import and Export
Applies to: image, heightmap
Settings: Real, Scaled, or Auto
Description: Determines the method for conversion between data types.

Vertex Accuracy

Type: Export
Applies to: mesh
Settings: 1...6
Description: Determines the number of decimal places of accuracy for the mesh vertices.

Vertex Spacing

Type: Export
Applies to: mesh
Settings: 1...65536
Description: Determines the number of units spacing along the X and Y between each mesh vertex.

Void Fill

Type: Import
Applies to: dem
Settings: Fill Style, Flag Value, Fill Value
Description: Fills voids, which are missing sample point data, in a digital elevation model data set.

Write Header

Type: Export
Applies to: dem, heightmap
Settings: True or False
Description: Writes a header or parameter file for those file types that have optional headers.

Z offset

Type: Export
Applies to: mesh
Settings: Absolute, Altitude Center, Heightmap Midpoint
Description: Determines the mesh location along the Z axis.

Z scale

Type: Export
Applies to: mesh
Settings: 0.01% ... 1000.00%
Description: Scales the heightmap altitude range values by the specified percentage.

Appendix B: Export and Import Type Conversion

Exporting to and importing from file formats that contain a different data type than the internal heightmap format will go through a type conversion process. The following table outlines the conversion for all supported data types.

Export Type Conversion

Export to 8-bit Unsigned Byte

Data range: 0 ... 255
Real: >> 8 (shift right 8 bits to 8-bit data type)
Scaled: >> 8 (shift right 8 bits to 8-bit data type)
Auto: scaled to fit the heightmap altitude into the full 8-bit range 0 ... 255 (Optimized 8-bit)

Export to 16-bit Signed Short

Data range: -32768 ... 32767
Real: -32768 to convert to signed (-32768 ... 32767 range)
Scaled: -32768 to convert to signed (-32768 ... 32767 range)
Auto: -32768 to convert to signed (-32768 ... 32767 range)

Export to 16-bit Unsigned Short

Data range: 0 ... 65535
Real: as is
Scaled: as is
Auto: as is

Export to 32-bit Signed Integer

Data range: -2,147,483,648 ... +2,147,483,647
Real: -32768 to convert to signed (-32768 ... 32767 range)
Scaled: -32768 to convert to signed, << 16 (shift left 16 bits to 32-bit data type)
Auto: -32768 to convert to signed, << 16 (shift left 16 bits to 32-bit data type)

Export to 32-bit Unsigned Integer

Data range: 0 ... 4,294,967,295
Real: as is
Scaled: << 16 (shift left 16 bits to 32-bit data type)
Auto: << 16 (shift left 16 bits to 32-bit data type)

Export to 64-bit Signed Long

Data range: -9,223,372,036,854,775,808 ... +9,223,372,036,854,775,807
Real: -32768 to convert to signed (-32768 ... 32767 range)
Scaled: -32768 to convert to signed, << 48 (shift left 48 bits to 64-bit data type)
Auto: -32768 to convert to signed, << 48 (shift left 48 bits to 64-bit data type)

Export to 64-bit Unsigned Long

Data range: 0 ... 18,446,744,073,709,551,615
Real: as is
Scaled: << 48 (shift left 48 bits to 64-bit data type)
Auto: << 48 (shift left 48 bits to 64-bit data type)

Export to 32-bit Signed Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45} \dots \pm 3.4 \times 10^{38}$
Real: -32768 to convert to signed (-32768 ... 32767 range)
Scaled: convert range to -1.0 ... 1.0
Auto: -32768 to convert to signed (-32768 ... 32767 range)

Export to 32-bit Unsigned Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45} \dots \pm 3.4 \times 10^{38}$
Real: as is
Scaled: convert range to 0.0 ... 1.0
Auto: as is

Export to 64-bit Signed Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324} \dots \pm 1.7 \times 10^{308}$
Real: -32768 to convert to signed (-32768 ... 32767 range)
Scaled: convert range to -1.0 ... 1.0
Auto: -32768 to convert to signed (-32768 ... 32767 range)

Export to 64-bit Unsigned Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324} \dots \pm 1.7 \times 10^{308}$
Real: as is
Scaled: convert range to 0.0 ... 1.0
Auto: as is

Import Type Conversion

Import from 8-bit Unsigned Byte

Data range: 0 ... 255
Real: as is 0 ... 255
Scaled: << 8 (shift left 8 bits to 16-bit data type)
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 16-bit Signed Short

Data range: -32768 ... 32767
Real: +32768 to convert to unsigned
Scaled: +32768 to convert to unsigned
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 16-bit Unsigned Short

Data range: 0 ... 65535
Real: as is
Scaled: as is
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 32-bit Signed Integer

Data range: -2,147,483,648 ... +2,147,483,647
Real: clamped to assumed range of -32768 ... 32767, +32768 to convert to unsigned
Scaled: >> 16 (shift right 16 bits to 16-bit data type), +32768 to convert to unsigned
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 32-bit Unsigned Integer

Data range: 0 ... 4,294,967,295
Real: clamped to assumed range of 0 ... 65535
Scaled: >> 16 (shift right 16 bits to 16-bit data type)
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 64-bit Signed Long

Data range: -9,223,372,036,854,775,808 ... +9,223,372,036,854,775,807
Real: clamped to assumed range of -32768 ... 32767, +32768 to convert to unsigned
Scaled: >> 48 (shift right 48 bits to 16-bit data type), +32768 to convert to unsigned
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 64-bit Unsigned Long

Data range: 0 ... 18,446,744,073,709,551,615
Real: clamped to assumed range of 0 ... 65535
Scaled: >> 48 (shift right 48 bits to 16-bit data type)
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 32-bit Signed Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45} \dots \pm 3.4 \times 10^{38}$
Real: clamped to assumed range of -32768 ... 32767, +32768 to convert to unsigned
Scaled: clamped to assumed range of -1.0 ... 1.0, convert to unsigned, scaled to 0 ... 65535
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 32-bit Unsigned Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45} \dots \pm 3.4 \times 10^{38}$
Real: clamped to assumed range of 0 ... 65535
Scaled: clamped to assumed range of 0.0 ... 1.0, scaled to 0 ... 65535
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 64-bit Signed Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324} \dots \pm 1.7 \times 10^{308}$
Real: clamped to assumed range of -32768 ... 32767, +32768 to convert to unsigned
Scaled: clamped to assumed range of -1.0 ... 1.0, convert to unsigned, scaled to 0 ... 65535
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Import from 64-bit Unsigned Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324} \dots \pm 1.7 \times 10^{308}$
Real: clamped to assumed range of 0 ... 65535
Scaled: clamped to assumed range of 0.0 ... 1.0, scaled to 0 ... 65535
Auto: scaled to fit into the full 16-bit range 0 ... 65535

Appendix C: File Formats

TerreSculptor supports a wide range of file formats including digital elevation model, heightmap, image, mesh and raw data. Each file format may support a number of additional importing and exporting features and sub-formats.

There are currently 28 file formats supported, in a total of 87 data formats.

Note that not all file formats support the large width and height dimensions supported by TerreSculptor.

Ext.	Description	Type	Data Formats
.3ds	Autodesk 3D Studio	mesh	1
.ase	Autodesk 3D Studio ASCII	mesh	1
.bil	band interleaved by line	digital elevation model	9
.bmp	Windows Bitmap	image	4
.bmp	Epic Unreal G16 Heightmap	heightmap	1
.bt	Binary Terrain	heightmap	3
.csv	comma separated value	heightmap	1
.dem	VistaPro 4 binary DEM	digital elevation model	2
.flt	GridFloat DEM	digital elevation model	2
.gif	Graphics Interchange Format	image	2
.hgt	SRTM height	digital elevation model	1
.obj	Alias Object	mesh	1
.pam	Portable AnyMap	image or heightmap	3
.pgm	Portable GrayMap	image or heightmap	4
.png	Portable Network Graphics	image	4
.r8	raw binary 8-bit	heightmap	2
.r16	raw binary 16-bit	heightmap	4
.r32	raw binary 32-bit	heightmap	4
.raw	raw binary	heightmap	21
.stl	Stereolitho	mesh	2
.t3d	Epic 3D Text	heightmap	1
.tab	tab separated value	heightmap	1
.ter	Terragen Terrain	heightmap	1
.tga	Truevision TARGA	image	5
.tif	Tagged Image Format	image	4
.tsv	tab separated value	heightmap	1
.txt	space separated value	heightmap	1
.txt	Vista Pro 4 ASCII DEM	digital elevation model	1

.3ds – Autodesk 3DS Max mesh

Format

Total format types: 1

Autodesk 3D Studio and Max mesh format.

Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.

Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing

Z offset

Z scale

Reverse vertex order

Rotate mesh origin

Include smoothing group

Notes

The 3DS file format only supports objects with a maximum of 65536 faces (triangles), which limits the heightmap mesh to a maximum square resolution of 181x181. A future version will allow exporting the entire terrain as multiple triangle strip objects.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.ase – Autodesk ASCII Scene Export

Format

Total format types: 1

Autodesk mesh format.

Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.

Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing

Z offset

Z scale

Accuracy

Reverse vertex order

Rotate mesh origin

Include smoothing group

Notes

ASE is a text format file type. Text format files are typically much larger than binary format files.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.bil – Band Interleaved by Line DEM

Format

Total format types: 9

ArcView and United States Geological Survey (USGS) National Elevation Dataset (NED) Digital Elevation Model. Only BIL Single-Band (one heightmap in file) binary format data files are supported.

The following data types are supported in either Motorola or Intel Byte Order: 8-bit Unsigned Byte, 16-bit Signed and Unsigned Short Integer, 32-bit Signed and Unsigned Floating Point.

The default format if no header file is included is: Intel 16-bit Signed Short Integer with Skip Bytes = 0.

A .hdr Header properties file should be included to specify the binary file properties.

Description

The USGS NED BIL files contain elevation data tiles of the earth at various resolutions. The tiles are available from a number of sources and usually include an .hdr Header properties file, and may also include a .prj Projection properties file. The Projection file is ignored by HMES.

These files are commonly available in 10 meter (1/3 arc-second), 30 meter (1 arc-second), 90 meter (3 arc-second), and 300 meter (10 arc-second) resolutions.

The tile data supports an elevation range from -32767 to +32767 meters. An elevation value of -32768 signifies a void (missing data sample). When imported into HMES, this range is converted to 1 to 65535, with a value of 0 signifying a void flag value.

Header Properties File

Varying tile Width and Height values, and various bit-depth data types, are supported through an .hdr Header file that contains a set of property values for the BIL file. The Header file is a multi-line ASCII text file that contains the following supported properties. Additional properties supported by the BIL .hdr file format that are not shown in this list are ignored by HMES.

Each property is the upper-case name followed by white-space (one or more tabs, or one or more spaces) and the property value. HMES ignores the case and will properly load lower-case, upper-case or mixed-case.

BYTEORDER	see note below	Intel or Motorola byte order
LAYOUT	BIL	must be "BIL"
NCOLS	<tile width>	eg: 1200
NROWS	<tile height>	eg: 1200
NBANDS	1	must be "1", files whose value is greater than 1 are not supported
NBITS	8 or 16 or 32	number of bits per data sample: 8-bit byte, 16-bit short, or 32-bit float
PIXELTYPE	see note below	the data sample type, typically absent when NBITS = 8
SAMPLETYPE	see note below	the data sample type, our custom HMES property
SKIPBYTES	0 to n	the number of bytes to skip to get to the sample data, typically 0
XDIM	<x arc-seconds>	eg: 3.000000000000, optional
YDIM	<y arc-seconds>	eg: 3.000000000000, optional

BYTEORDER may be one of the following: M or MOTOROLA or MSBFIRST, or, I or INTEL or LSBFIRST. I, INTEL, LSBFIRST are for PC format files, and M, MOTOROLA, MSBFIRST are for Mac format files. HMES supports both types. 8-bit byte data (NBITS = 8) will ignore the BYTEORDER property entry.

PIXELTYPE may be one of the following: SIGNEDINT, UNSIGNEDINT, FLOAT, or FLOATINGPOINT.

INT entries are for 16-bit Short Integer data type, and FLOAT entries are for 32-bit Floating Point data type.

8-bit byte data (NBITS = 8) will ignore the PIXELTYPE property entry.

The SAMPLETYPE entry is our own custom property that supersedes both of the ambiguous NBITS and PIXELTYPE entries. NBITS and PIXELTYPE are supported for compatibility with other software, however, HMES will give SAMPLETYPE higher precedence if it is present in the header. SAMPLETYPE must be one of the following:

UNSIGNEDBYTE, SIGNEDSHORT, UNSIGNEDSHORT, SIGNEDSINGLE, UNSIGNEDSINGLE.

Unsupported Header Entries

The following header entries are not supported and are ignored by HMES.

BANDROWBYTES	the number of columns times the number of bytes per pixel, when NBANDS > 1.
TOTALROWBYTES	the number of columns times the number of bytes per pixel, when NBANDS > 1.
BANDGAPBYTES	must be 0 for single band images.
ULXMAP	.
ULYMAP	.
XLLCENTER	x center.
YLLCENTER	y center.
CELLSIZE	.
NODATA	the altitude value for DEM voids, typically -32768.

Import Options

Width
Height
Byte order
Data type
Type conversion
File offset

Export Options

Byte order
Data type
Type conversion
Write header
Header type

Notes

The optional XDIM and YDIM are read on import strictly for informational purposes, and are converted to meters.

.bmp – Windows Bitmap

Format

Total format types: 4+1

The Windows Bitmap format is very popular for storing standard grayscale and color images.

The following BMP formats are supported for import and export:

8-bit Grayscale	with a 24-bit RGB palette
8-bit Paletted	with a 24-bit RGB palette
16-bit Grayscale	the Epic Unreal G16 heightmap format
24-bit RGB Color	
32-bit ARGB Color	

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit
Orientation

Supported Orientations

Left to right, Top to bottom
Left to right, Bottom to top

Notes

Only the uncompressed format is supported at this time.
The .bmp 16-bit Grayscale format is the Epic G16 format.
HMES can read and write to the 32-bit format Alpha Channel which is not supported on most other software.

.bt – Binary Terrain

Format

Total format types: 3

VTP Binary Terrain digital elevation model file format supported by numerous open-source and retail heightmap, terrain, and GIS applications for saving and transferring of digital elevation model data.

The following data types are supported: 16-bit Integer, 32-bit Integer, and 32-bit Floating-Point.

TerreSculptor supports importing and exporting all four BT file format versions from 1.0 (1997) through 1.3 (2007).

Import Options

Type conversion

Export Options

File version

Data type

Type conversion

Notes

The following BT properties are ignored by TerreSculptor:

- UTM Zone
- Datum
- Horizontal and Vertical Units (scale)
- Extents (Left, Right, Top, bottom)
- Internal Projection
- External Projection

.csv .tab .tsv .txt – Delimited ASCII Text and Vista Pro 4 ASCII DEM

Format

Total format types: 1+1+1+1+1

This is the standard ASCII delimited formats.

The supported delimiters include comma (.csv), tab (.tab and .tsv), and space (.txt).

Each heightmap row is written to an individual line as multiple fields separated by the delimiter.

Each numeric value is prefixed with the number of required 0's to be either three digits 000...255 for 8-bit range or five digits 00000...65535 for 16-bit range. This allows for easier reading in text editors that use a fixed font as all columns are aligned.

Each heightmap row line is terminated by a CRLF.

Import Options

Auto-scale to 16-bit

Export Options

Encoding: ASCII (default) or Unicode or UTF-8

Integer range: 8-bit or 16-bit

Optimized 8-bit

Orientation

Write header

Supported Orientations

Left to right, Top to bottom

Left to right, Bottom to top

Notes

Only ASCII format is currently supported for importing.

Heightmaps saved for Vista Pro 4 ASCII DEM format must be saved in ASCII encoding, 16-bit range, LRBT orientation, no Header, to be compatible with Vista Pro 4.

It is not recommended to use Unicode encoding formats to save heightmap files since the file size can become extremely large. For example, an 8192x8192 16-bit heightmap saved as UTF-32 will result in a text file larger than 1.6GB.

Unicode files will have to be converted to ASCII prior to importing using Notepad or another compatible text editor. An attempt is made to recognize common Unicode format text files and provide a warning to convert the file to ASCII before importing. This is only possible if the text file contains the Unicode preamble or BOM (byte order marking) information at the start of the file.

.dem – VistaPro 4 binary DEM

Format

Total format types: 2

VistaPro version 4 binary digital elevation model.

File import supports both compressed and uncompressed formats.

File export supports uncompressed format.

During file import, the DEM altitude data is automatically scaled and centered.

During file export, the following limitations are imposed:

- The DEM data is always 258x258 samples.
Heightmap resolutions other than this will be resampled to 258x258.
- The DEM data altitude range is 0 to 16000.
Heightmap ranges greater than 16000 will be scaled to 0 to 16000.

Import Options

None.

Export Options

Name

Comment

Notes

The Colormap data is ignored.

The DEM data is assumed by VistaPro 4 to be 30 meter sample spacing and 1 meter altitude spacing.

.flt – GridFloat DEM

Format

Total format types: 2

ArcGIS GridFloat binary digital elevation model.

The ancillary files are ignored and only the .flt file that contains the actual altitude float values is used for heightmap information.

Import Options

Width override
Length override
Byte order

Export Options

Byte order
Save .hdr header properties file

.gif – Graphics Interchange Format

Format

Total format types: 2

The GIF format is one of the image standards for Internet and image transfer. GIF supports a paletted image of up to 256 gray-levels or 256 colors.

The following GIF formats are supported for import and export:

8-bit Grayscale	with a 24-bit grayscale palette
8-bit Paletted	with a 24-bit RGB palette

Import Options

Source: Grayscale, Red, Green, Blue
Auto-scale to 16-bit

Export Options

Source: Grayscale, Red, Green, Blue
Optimized 8-bit

Notes

The heightmap data is saved as an 8-bit grayscale palette image.

.hgt – SRTM DEM Heightmap

Format

Total format types: 1

Shuttle Radar Topology Mission Digital Elevation Model.

Typically available in 30 meter (1 arc-second) and 90 meter (3 arc-second).

All SRTM formats are supported.

SRTM HGT files are normally 16-bit signed big-endian with a left-to-right top-to-bottom format.

Description

The Shuttle Radar Topology Mission HGT files contain elevation data tiles of the earth at various resolutions. The tiles are available from a number of sources and usually have the following file naming convention:

<latitude><longitude>.hgt

The file name is the latitude and longitude of the bottom-left corner sample point of the SRTM file. For example, a file named N36W005.hgt would be North 36:00:00 latitude and West 5:00:00 longitude.

The tile data supports an elevation range from -32767 to +32767 meters. An elevation value of -32768 signifies a void (missing data sample). When imported into HMES, this range is converted to 1 to 65535, with a value of 0 signifying a void flag value.

HGT files are a square aspect ratio whose dimensions vary depending on the source resolution. 90 meter files are commonly 1201x1201 with a file size of 2.75MB (2,884,802 bytes), while 30 meter files are commonly 3601x3601 with a file size of 24.7MB (25,934,402 bytes).

Non-square-aspect files cannot be imported unless a Header properties file is supplied along with the HGT file. The Header file is custom for HMES and normally unsupported by other SRTM software.

The Width and Height are pre-determined by the file size, or the optional Header properties, and cannot be modified.

Header Properties File

The optional Header properties file contains a set of property values for the HGT file. The Header file is a multi-line ASCII text file with the same file name as the HDR file with a file extension of .hgp, and contains the following supported properties. Each line is terminated with a CRLF. Any line cannot be longer than 80 characters not including the CRLF line terminator. There is a single space character between each property and value pair. Case is not strict and can be upper or lower or mixed. A Resolution value of 0 is "unknown".

<comment>	SRTM HGT N38W112	normally SRTM HGT followed by the HGT's file name
Width <value>	Width 3601	x sample points, supports 1 to 65536
Height <value>	Height 3601	y sample points, supports 1 to 65536
Resolution <value>	Resolution 30	spatial resolution in meters, supports 5, 10, 30, 60, 90, 300

Import Options

Void fill style
Void flag value
Void fill value

Export Options

Write header

.obj – Alias Object ASCII Mesh

Format

Total format types: 1

Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.

Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing

Z offset

Z scale

Vertex Accuracy

Reverse vertex order

Rotate mesh origin

Notes

Autodesk 3DS Max requires that the vertex order be reversed to render the face normals in the upward direction.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.pam – Portable AnyMap Binary Image or Heightmap

Format

Total format types: 3

PAM files are always unsigned big-endian format.

The following PAM formats are supported for import and export:

P7 - 8-bit Grayscale
P7 - 16-bit Grayscale
P7 - 24-bit RGB Color

Import Options

Auto-scale to 16-bit
Source: Grayscale, Red, Green, Blue

Export Options

Format
Integer Range
Source: Grayscale, Red, Green, Blue
Optimized 8-bit

.pgm – Portable GrayMap ASCII and Binary Image or Heightmap

Format

Total format types: 4

PGM files are always unsigned big-endian format.

The following PGM formats are supported for import and export:

P2 - 8-bit ASCII Grayscale
P2 - 16-bit ASCII Grayscale
P5 - 8-bit Binary Grayscale
P5 - 16-bit Binary Grayscale

Import Options

Auto-scale to 16-bit
Source: Grayscale, Red, Green, Blue

Export Options

Format
Integer Range
Source: Grayscale, Red, Green, Blue
Optimized 8-bit

.png – Portable Network Graphics

Format

Total format types: 4

The PNG format is one of the image standards for Internet and image transfer. PNG supports a wide range of image formats including grayscale, paletted and planar, and up to 48-bit color plus alpha channel.

The following PNG formats are supported for import:

8-bit Grayscale
8-bit Paletted with a 24-bit RGB palette
24-bit RGB
32-bit RGB with alpha

The following PNG formats are supported for export:

8-bit Paletted with a 24-bit RGB palette
24-bit RGB

Import Options

Source: Grayscale, Red, Green, Blue
Auto-scale to 16-bit

Export Options

Source: Grayscale, Red, Green, Blue
Optimized 8-bit

Notes

The heightmap data is saved as an 8-bit grayscale palette image when 8-bit Paletted format is chosen.

.r8, .r16, .r32, .raw – RAW Heightmap

Format

Total format types: 21

Essentially twenty-one different RAW formats are supported, including 8-bit byte, 16-bit short integer, 32-bit integer, 64-bit long integer, 32-bit single-precision floating point, and 64-bit double-precision floating point; in Intel and Motorola byte order where applicable, and in signed and unsigned where applicable. The floating point formats also support real-number or scaled 0.0-to-1.0 ranges.

The raw data is assumed to be an XxY grid of heightmap sample point altitudes.

The RAW Format property and file extension is used to determine the data contents of the file:

.r8 8-bit unsigned byte
.r16 16-bit short integer, signed or unsigned, Intel or Motorola byte order
.r32 32-bit single-precision float, signed or unsigned, real or scaled, Intel or Motorola byte order
.raw can be any of the following:
8-bit unsigned byte,
16-bit short integer in signed or unsigned and Intel or Motorola,
32-bit integer in signed or unsigned and Intel or Motorola,
64-bit long integer in signed or unsigned and Intel or Motorola,
32-bit single-precision floating point in signed or unsigned and real or scaled and Intel or Motorola,
64-bit double-precision floating point in signed or unsigned and real or scaled and Intel or Motorola

RPL RAW Parameter List Properties File

RAW file properties are supported through a RAW Parameter List .rpl file that contains a set of property values that define the contents of the RAW binary data file.

The RPL file is a multi-line ASCII text file that contains the following supported properties. Additional properties supported by the RAW RPL file format are ignored by HMES.

Each property entry is the lower-case property name followed by white-space (one or more tabs, or one or more spaces) and the property value. Any line that begins with a semicolon (;) is regarded as a comment and is ignored. The line with "key" and "value" must be present in an RPL file but is ignored by HMES.

The "sample-type" entry is our custom property that is used to alleviate the ambiguous meanings and missing data types with the default RPL data-length and data-type entries. This entry is not supported by most other software.

;comment	comment	;HMES Heightmap Raw Parameter List	* optional
key	value	key value	* ignored
width	<raw width>	eg: 256	
height	<raw height>	eg: 256	
depth	<number of raw blocks>	must be 1 if present	* optional
offset	<file offset to data>	must be between 0 and the file length -1 if present	* optional
data-length	<bytes per raw sample>	must be 1 for 8-bit, 2 for 16-bit, 4 for 32-bit, 8 for 64-bit	
data-type	<raw data type>	must be "signed", "unsigned", or "float" 8-bit is always "unsigned"	
byte-order	<raw data byte order>	must be "big-endian", "little-endian", or "dont-care" big-endian = Motorola, little-endian = Intel 8-bit is always "dont-care"	
record-by	<raw, image or vector>	must be "dont-care" if present	* optional
sample-type	<data type>	must be one of the following: unsigned-byte, signed-short, unsigned-short, signed-integer, unsigned-integer, signed-long, unsigned-long, signed-single, unsigned-single, signed-double, unsigned-double	* optional

Import Options

Format (r8, r16, r32, raw)
Width
Height
Data type
Type conversion
Byte order
File offset

Export Options

Format (r8, r16, r32, raw)
Write header (write a RPL parameter file)
Data type
Type conversion
Byte order
File offset

Notes

The Format property values of r8, r16, and r32 determine whether the RAW file written is fixed as an 8-bit unsigned byte, 16-bit short integer, or 32-bit single-precision floating point data format.

The File Offset property allows for importing a chunk of binary data that is located at virtually any location within a file. This allows the use of the RAW importer to import additional unsupported file types through the proper use of the import properties, where the chunk dimensions are specified along with the number of file header bytes to skip over.

.stl – StereoLitho ASCII and Binary Mesh

Format

Total format types: 2

Both ASCII and Binary formats are supported.

Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.

There is no support for multiple objects, all vertices are assumed to be a single plane mesh.

Import Options

na

Export Options

Format

Vertex spacing

Z offset

Z scale

Vertex Accuracy

Reverse vertex order

Rotate mesh origin

Notes

Autodesk 3DS Max requires that the vertex order be reversed to render the face normals in the upward direction.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.t3d – Epic 3D Text

Format

Total format types: 1

Unreal Engine 3 3D ASCII Text Terrain format.

Supports the Terrain Actor only.

Import Options

none

Export Options

none

.tab – TAB Delimited ASCII Text

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

.ter – Terragen Terrain

Format

Total format types: 1

HMES supports the Terragen Classic (1.0) file format properties relevant to the heightmap data.

Heightmap sizes from 2x2 up to the HMES maximum heightmap dimensions are supported.

Both square and rectangular heightmaps are supported for both import and export.

HMES supports the Terragen file format properties (chunks) for SIZE, XPTS and YPTS, ALTW, and EOF.

HMES ignores the file format properties (chunks) for CRAD (curve radius), CRVM (curve mode), and SCAL (terrain scale in meters).

HMES always writes out the optional XPTS and YPTS chunks even if the heightmap is square.

“TERRAGEN”

“TERRAIN “

“SIZE” n-1 (if the heightmap is rectangular then SIZE is the shorter dimension -1)

“XPTS” width

“YPTS” length

“ALTW” HeightScale, BaseHeight, heightmap data width*length signed shorts

“EOF “

Import Options

none

Export Options

none

Notes

TerreSculptor imports and exports Terragen Terrain files flipped vertically (Left-Right Bottom-Top) so that the terrain orientation within TerreSculptor matches the Terragen Classic top-down preview.

Terragen Terrain format files created with World Machine have an n+1 resolution. In other words, a 1024×1024 World Machine heightmap is exported as a 1025×1025 Terragen file.

.tga – Truevision TARGA

Format

Total format types: 5

The following TGA formats are supported for import and export:

8-bit Grayscale
8-bit Paletted with a 24-bit RGB Palette
16-bit Grayscale
24-bit RGB Color
32-bit ARGB Color

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit
Orientation
Enhanced Format

Supported Orientations

Left to right, Top to bottom
Left to right, Bottom to top
Right to left, Top to bottom
Right to left, Bottom to top

Notes

Normal and Enhanced (Extended) TGA Format is supported.
Only the uncompressed format is supported.
Only the non-scanline-interleave format is supported.
Not all software supports the 16-bit Grayscale format.
Not all software supports Right-to-Left orientation.

.tif – Tagged Image Format

Format

Total format types: 4

The following TIF formats are supported for import and export:

8-bit Grayscale	with a 24-bit RGB palette
8-bit Paletted	with a 24-bit RGB palette
16-bit Grayscale	
24-bit RGB Color	

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit

Supported Orientations

Left to right, Top to bottom

Notes

Only the uncompressed format is supported at this time.

.tsv – TAB Delimited ASCII Text

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

.txt – Space Delimited ASCII Text and Vista Pro 4 ASCII DEM

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

Appendix D: Obtaining DEM Data

A DEM or Digital Elevation Model is a file that contains real altitude information gathered from areas of the earth or other planets in our solar system. The DEM data is typically collected by orbiting a satellite, the shuttle, or an airplane around the planet and performing altitude distance measurements using radar or other means. These stripes of altitude distance measurements are then converted and compiled into files based on planetary latitude and longitude values. The final DEM data is often available at no charge from a variety of websites, typically operated by organizations or governments.

For use as typical heightmaps in video games and 3D rendering, DEM data should be at least 10 meter or higher resolution, 16-bit or greater bit-depth, with an altitude range of more than 1000 samples.

DEM Sample Spacing

DEM data is normally measured in meters between sample points, but may be using one of the additional equivalent scales. The meters value is only approximate, the arc-seconds value is typically accurate. Meters and arc-seconds for terrestrial DEM data are shown in the table below.

Meters	Arc Seconds
1 meter	1/27 th (0.037) arc-second
3 meter	1/9 th (0.111) arc-second
5 meter	1/6 th (0.167) arc-second
10 meter	1/3 rd (0.334) arc-second
30 meter	1 arc-second
60 meter	2 arc-seconds
90 meter (100 meter)	3 arc-seconds
300 meter	10 arc-seconds

DEM Spacing to Engine Units

DEM data is typically provided in meters, whereas TerreSculptor and many video game engines are scaled in centimeters, such as TerreSculptor's default 1 cm unit scaling and the Epic UDK's 1 unreal unit = 2 cm scaling.

To determine the proper terrain vertex spacing within TerreSculptor or a video game engine so that the DEM data is scaled correctly, simply convert the DEM sample spacing to the equivalent engine units.

TerreSculptor example:

A 5 meter DEM is 5 meter spacing between sample points. 5 meters is 500 centimeters.

The engine scale is 1 unit = 1 cm.

Therefore, a terrain units XZ spacing of 500 is 5 meters (500 cm / 1 cm = 500).

UDK example:

A 5 meter DEM is 5 meter spacing between sample points, 5 meters is 500 centimeters.

The engine scale is 1 unit = 2cm.

Therefore, a DrawScale3D.X/Y spacing of 250 is 5 meters (500 cm / 2 cm = 250).

DEM Properties Files

Some of the DEM file formats are headerless raw binary data files and therefore support an additional ASCII text file that contains the DEM properties.

These properties typically include the data samples width, data samples length, data bit-depth (bits per sample such as 16-bit), data endian (Intel/PC or Motorola/Mac), data integer sign (signed or unsigned), etc.

When working with DEMs, if the properties file is not included by the source supplier, it can be advantageous to create the properties file in order that TerreSculptor has the correct file information for importing.

DEM Dataset Links

For current up-to-date links and file format support information, visit the [TerreSculptor Wiki](#) web site.

Appendix D: Keyboard Shortcuts

To be completed.

-eof-